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List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

Colour Codes		
Employability Contents	Green	
Entrepreneurship Contents	Light Blue	
Skill Development Contents	Pink	
Name of the Subjects/Related to all three Components (Employability/ Entrepreneurship/ Skill Development)	Yellow	



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Industrial and Production Engineering

Programme Name : B.Tech.

Academic Year : 2021-22

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	IP3TBS01	STATISTICAL METHODS
02.	IP3TES11	STRENGTH OF MATERIALS
03.	IP3TES12	MATERIAL SCIENCE AND METALLURGY
04.	IP3TPC11	THEORY OF MACHINE
05.	IP3TPC12	MANUFACTURING PROCESSES - I
06.	IP3LPC11	THEORY OF MACHINE LAB
07.	IP3LES12	STRENGTH OF MATERIALS LAB
08.	IP3THS11	ENGINEERING ECONOMICS
09.	IP3THS12	WORK STUDY AND ERGONOMICS
10.	IP4TBS02	NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING
11.	IP4TPC21	MACHINE DRAWING
12.	IP4TPC22	INDUSTRIAL ENGINEERING
13.	IP4TPC23	MANUFACTURING PROCESSES-II
14.	IP4TPC24	FLUID MECHANICS
15.	IP4LPC21	NACP
16.	IP4LPC24	FLUID MECHANICS LAB
17.	IP4TPE11	BUSINESS COMMUNICATION AND PRESENTATION SKILL
18.	IP4TPE12	OCCUPATIONAL HEALTH AND SAFETY



19	IP4TPE13	BUSSINESS ETHICS AND CORPORATE GOVERNANCE
20	IP5TPC31	METAL CUTTING
21	IP5TPC32	FLUID MACHINERY
22	IP5TPC33	MACHINE DESIGN- I
23	IP5TPE21	TURBO MACHINES
24	IP5TPE22	INTERNAL COMBUSTION ENGINE
25	IP5TPE23	MEMS AND NANO TECHNOLOGY
26	IP5TPE31	TOTAL QUALITY MANAGEMENT
27	IP5TPE32	INDUSTRIAL AUTOMATION
28	IP5TPE33	MECHATRONICS
29	IP5TOE11	FINANCIAL MANAGMENT
30	IP5TOE12	MANAGERIAL ECONOMICS
31	IP5TOE13	FINANCIAL ACCOUNTING AND COSTING
32	IP5LPC31	METAL CUTTING LAB
33	IP5LPC32	FLUID MACHINERY LAB
34	IP5LPC33	SEMINAR
35	IP6TPC41	MACHINE DESIGN- II
36	IP6TPC42	MEASUREMENT, METROLOGY & CONTROL
37	IP6TPC43	WELDING ENGINEERING
38	IP6TPE41	MATERIAL MANAGEMENT
39	IP6TPE42	PLANT LAYOUT AND MATERIAL HANDLING
40	IP6TPE43	MAINTANCE AND RELIABILITY ENGINEERING
41	IP6TPE51	Automobile Engineering
42	IP6TPE52	POWER PLANT ENGINEERING
43	IP6TPE53	HEAT & MASS TRANSFER



44	IP6TOE21	ENTERPRISE RESOURCE PLANNING
45	IP6TOE22	MANAGEMENT INFORMATION SYSTEM
46	IP6TOE23	SIX SIGMA AND DOE
47	IP6LPC42	MEASUREMENT AND METROLOGY LAB
48	IP6LPC43	WELDING ENGINEERING LAB
49	IP7TPC51	PRINCIPLES OF MANAGEMENT
50	IP7TPC52	PRODUCTION PLANNING AND CONTROL
51	IP7TPC53	CAD/CAM
52	IP7TOE31	PRODUCT DESIGN & DEVELOPMENT
53	IP7TOE32	ENTERPRENUERSHIP DEVELOPMENT
54	IP7TOE33	STRATEGIC MANAGEMENT
55	IP7TPE61	MACHINE TOOL DESIGN
56	IP7TPE62	REFRIGERATION AND AIR CONDITIONING
57	IP7TPE63	COMPOSITE MATERIALS AND TECHNOLOGY
58	IP7LPC53	CAD/CAM LAB
59	IP7LPC54	SEMINAR ON SUMMER TRAINING (ABOUT 30 DAYS)
60	IP7LPC55	MINOR PROJECT
61	IP8TPC61	OPERATION RESEARCH
62	IP8TPC62	MARKETING MANAGEMENT
63	IP8TOE41	SUPPLY CHAIN MANAGEMENT
64	IP8TOE42	SAFETY MANAGEMENT AND LABOUR LAW
65	IP8TOE43	FINITE ELEMENT METHOD
66	IP8TPE71	FLUID POWER AND CONTROL
67	IP8TPE72	ROBOTICS AND ROBOT APPLICATION
68	IP8TPE73	POWDER METALLURGY & CERAMICS



69	IP8LPS02	MAJOR PROJECT
70	IP8LPC01	COMPREHENSIVE VIVA
71	IP01TBS01	MATHEMATICS-II
72	IP01TBS02	CHEMISTRY
73	IP01TES01	PROGRAMMING FOR PROBLEM SOLVING
74	IP01TES02	ENGINEERING MECHANICS
75	IP01PBS01	CHEMISTRY LAB
76	IP01PES01	PROGRAMMING FOR PROBLEM SOLVING LAB
77	IP01PES02	WORKSHOP AND MANUFACTURING PRACTICES
78	IP01PES03	ENGINEERING MECHANICS LAB
79	IP01PMC01	INDUCTION TRAINING PROGRAMME
80	IP02TBS03	PHYSICS
81	IP02TES03	BASIC ELECTRICAL ENGINEERING
82	IP02TBS04	MATHEMATICS-I
83	IP02THS01	ENGLISH
84	IP02THS02	ENVIRONMENTAL SCIENCES
85	IP02PBS02	PHYSICS LAB
86	IP02PES04	BASIC ELECTRICAL ENGINEERING LAB
87	IP02PES05	ENGINEERING GRAPHICS AND DESIGN
88	IP07TMC02	Indian Constitution
89	IP07TPE51	Fundamentals Of Green Manufacturing
90	IP07TOE21	Advanced Manufacturing Processes
91	IP07TOE23	Maintenance Management
92	IP08TMC03	Essence Of Indian Traditional Knowledge
93	IP08THS41	Intellectual Property Rights

गुरु घासीदास विश्वविद्यालय
(केन्द्रीय विश्वविद्यालय अधिनियम 2009 क्र. 25 के अंतर्गत स्थापित केन्द्रीय विश्वविद्यालय)
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya
(A Central University Established by the Central Universities Act 2009 No. 25 of 2009)
Koni, Bilaspur - 495009 (C.G.)

94	IP08TOE31	Computer Aided Process Planning
95	IP08TOE32	Microprocessors In Automation

विभागाध्यक्ष/Head
औद्योगिक एवं उत्पादन अभियांत्रिकी
Industrial & Production Engineering
सैद्धांतिकी संस्थान/Engineering & Technology
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

गुरु घासीदास विश्वविद्यालय
(केन्द्रीय विश्वविद्यालय अधिनियम 2009 क्र. 25 के अंतर्गत स्थापित केन्द्रीय विश्वविद्यालय)
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Scheme and Syllabus



INSTITUTE OF TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA
(A CENTRAL UNIVERSITY ESTABLISHED BY THE CENTRAL UNIVERSITY ORDINANCE 2009, NO: 3 OF
2009)

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
STUDY & EVALUATION SCHEME
W.E.F. SESSION 2016-2017

Year: B.Tech. II year

SEMESTER-III

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP3THS..	Elective-HS3	3	0	0	40	60	100	3
2.	IP3TBS01	Statistical Methods	3	1	-	40	60	100	4
3.	IP3TES11	Strength of Materials	3	1	0	40	60	100	4
4.	IP3TES12	Materials Science and Metallurgy	3	0	0	40	60	100	3
5.	IP3TPC11	Theory of Machine	3	0	0	40	60	100	3
6.	IP3TPC12	Manufacturing Processes-I	3	0	0	40	60	100	3
Total			18	02	0	240	360	600	20
PRACTICALS									
1.	IP3LPC11	Theory of Machine	-	-	03	45	30	75	2
2.	IP3LES12	Strength of Materials	-	-	03	45	30	75	2
Total					06	90	60	150	04

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Elective-Humanities Science (HS)	
S.N.	IP3THS...
11.	Engineering Economics
12.	Work Study and Ergonomics



DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3THS11 ENGINEERING ECONOMICS (Elective)

Unit 1: Basic Concepts and Definitions, Methodology of Economics, Demand and Supply – elasticity, Theory of the Firm and Market Structure, Price and output determinations in different types of market

Unit 2: Public Sector Economics – Welfare economics, Central and commercial ^{Banks} marks and their functions, Industrial policies, theory of localization, Weber & Sargent Florence theory, investment analysis-NPV, ROI, IRR, Payback period, SWOT analysis.

Unit 3: Monetary and Fiscal Policy; Tools, impact on the economy, Inflation, Business Cycle, Cash Flow-2,3,4 Model.

Unit 4: Business Forecasting – Elementary techniques. Cost and Revenue Analysis, Capital Budget, Break Even Analysis.

Unit 5: Indian economy; Urbanization, Unemployment–Poverty, Regional Disparities, Unorganized Sectors- Role of Plans, Reforms-Post Independent period.

Text Books:

1. Mankiw Gregory N.(2002), Principles of Economics, Thompson Asia
2. V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill
3. Misra, S.K. and Puri (2009), Indian Economy, Himalaya
4. Pareek Saroj (2003), Textbook of Business Economics, Sunrise Publishers

Recommended Books:

1. Kapila U. Indian economy since Independence. Academic Foundation, New Delhi
2. Misra, S. K. and Puri V. K. Indian Economy — Its Development Experience. Himalaya Publishing House, Mumbai
3. Dutt R. and Sundharam K. P. M. Indian Economy. S. Chand & Company Ltd., New Delhi.
4. Mathur R. Indian Economic Policy and Reform. RBSA Publisher, Jaipur
5. Jalan B. Indian Economic Policy. Penguin Books Ltd
6. Government of India, Economic Survey (Annual), Economic Division, Ministry of Finance, New Delhi.



DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3THS12 WORK STUDY AND ERGONOMICS (Elective)

Unit I

Introduction to man machine systems and ergonomics, Human factors in design and engineering, Needs of ergonomics and aesthetic design, Physiological aspects of work.

Unit II

Work measurement through physiological tests, Work physiology, Paced and unpaced work performance, Data logging, data collection, data reduction and analysis techniques, Gross human anatomy, Anthropometry, Bio mechanics, muscle strength and exertion potential of different limbs.

Unit III

Workcapacity, Environmental effects, exercises for evaluation of postural form and work spaces, Environmental conditions including temperature, illumination, noise and vibration.

Unit IV

Perception and information processing, design of displays, hand control, typography, and readability, layout and composition.

Unit V

Exercises in evaluation of human response to product interface, product safety and product liability, Design consideration for appearance, colour, texture and forms.

Recommended Books:

1. D. C. Alexander, *Applied Ergonomics*, Taylor & Francis.
2. Jan Dul, *Ergonomics for Beginners*, Taylor & Francis.
3. David Pye, *The Nature & Aesthetics of Design*, Cambium Press.



DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3TBS01 STATISTICAL METHODS

UNIT-I

Introduction to statistics, mathematical statistics, variable, frequency distribution, exclusive and inclusive class intervals type of series graphical representation histogram frequency polygon give measure of central tendency variation type of average, Mean median mode for grouped and un grouped data, geometric mean, harmonic mean, measure of description Skewness and Kurtosis.

UNIT- II

curve fitting and Method of least square - straight line parabola correlation - scatter diagram's Karl Pearson's coefficient of correlation, Limits for correlation coefficient, Coefficient of correlation for bivariate frequency distribution, rank correction. Regression linear regression, Equation to the line of Regression. Regression coefficient, Angle between two lines of Regression

UNIT- III

Theory of Probability - Mathematical and statistical definition of probability Sample space, finite sample space sample point, Events Theorem of total probability, Sample and compound event, Conditional probability, Theorem of compound probability, Bay's theorem, Use of binomial theorem.

UNIT- IV

Theoretically Distribution - Binomial Distribution Mean, Standard deviation and Pearson's β and γ coefficient. Poisson distribution, mean, variance normal Distribution.

Unit V Random and simple sampling - mean and standard deviation in simple sampling of attribute test of significance for large sample test of significance based on Chi square, T, F, and Z Distribution Degree of freedom, condition for applying

UNIT- V

Simulation Basic concept of simulation, applications of simulation, merits and demerits of simulation, Monte Carlo simulation, simulation of Inventory system, simulation of Queuing system.

Recommended Books:

1. Mathematical Statistics by M. Ray
2. S. C. Gupta and Kapoor - Fundamental of Mathematical Statistic
3. A.A. AFFI - Statistic Analysis
4. Probability & Statistics by Biswal, PHI



DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3THS13 EMPLOYEE RELATIONS (Elective)

UNIT-I

Conceptual framework of employment relations: Concept, Scope and Approaches to Industrial Relations, Evolution of Industrial Relations and Current Developments, Constitutional and Legal Framework of Industrial Relations :Conventions, ID Act, Trade Union Act

UNIT-II

Trade unionism: Trade Union Development and Functions, Trade Union Structure and Recognition, Managing Trade Unions, Managerial Unionism, Employers' Organisations

UNIT-III

Collective bargaining: Nature and Content of Collective Bargaining, Negotiation Skills, Issues and Trends in Collective Bargaining

UNIT-IV

Employee Involvement: Evolution, Structure and Process, Design and Dynamics of Participative Forums, Strategies for Implementing Participation

UNIT-V

Grievance Handling And Discipline: Grievance Function in Industrial Relations, Conciliation, Arbitration and Adjudication, Discipline in Industry

Recommended Books:

1. Employee Relations Management, Singh P. N. , Pearson Education India
2. Personnel Management Theory And Practice, 3 Vols. Set, Arun Kumar, Rachana Sharma, Atlantic Publishers & Distri
3. Industrial Relations And Personnel Management, Simon A George M V Pylee, Vikas Publishing House Pvt Ltd

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3TES11 STRENGTH OF MATERIAL

UNIT-I

Simple stresses and strains: Concept of stress and strain; principle of stress and strain diagram, Hooke's law, Young's modulus, Poisson ratio, stress at a point, stresses and strains in bars subjected to axial loading, Modulus of elasticity, Relationship between elastic constants, stress produced in compound bars subjected to axial loading, Temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound walls.

Compound stresses and strains: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress and strain, Two dimensional stress-strain system, principal strains.

UNIT-II

Bending moment and shear force diagrams: Bending moment and shear force diagrams, S F and B M diagram for different types of loading under different conditions with problems.

Theory of bending stresses: Assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular and channel sections, composite/fletched beams, bending and shear stresses in composite beams.

UNIT-III

Slope and Deflection of beams: Definition, double integration, area moment method, Macaulay's methods, Conjugate beam, method of Superposition.

Strain energy: Resilience stress due to suddenly applied loads, Castigliano's theorem, Maxwell's theorem of reciprocal deflection.

UNIT-IV

Torsion: Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity.

Close-coiled-helical springs: Analysis and derivation of expression of closed coil helical spring and their problems.

Columns and struts: Columns under uni-axial load, Buckling of Columns, Slenderness ratio and conditions. Derivations of Euler's formula for elastic buckling load, equivalent length, Rankine Gordon's empirical formula.

UNIT-V

Thin pressure vessel: Derivation of formulae and calculations of hoop stress longitudinal stress in a cylinder, and sphere subjected to internal pressures increase in Diameter and volume.

Theories of Failure: Various theories with problems.

Recommended Books:

1. Pytel A H and Singer F L, "Strength of Materials", 4th Edition, Harper Collins, New Delhi.
2. Beer P F and Johnston (Jr) E R, "Mechanics of Materials", SI Version, Tata McGraw Hill, India.
3. Popov E P, "Engineering Mechanics of Solids", SI Version 2nd Edition, Prentice Hall of India, New Delhi.
4. Timoshenko S P and Young D H, "Elements of Strength of Materials", 5th Edition, East West Press, New Delhi.
5. Jindal U C, "Introduction to Strength of Materials", 3rd Edition, Galgotia Publishing Private Limited New Delhi.



DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

6. Strength of materials Ryder, G.H.,
7. Elements of Strength of material Timoshenko. East West press
8. Mechanics of solids, Popov, PHI Publications

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3TES12 MATERIAL SCIENCE AND METALLURGY

UNIT-I

Introduction: Classification of engineering Materials, metals, non metals, plastics, ceramics and composites. Crystalline structure of solids: concepts of unit cell and space lattice, miller indices, crystal structure determination by X-ray diffraction. Crystal structure of ferrous and non-ferrous metals, crystal imperfections.

Plastic Deformation: Mechanisms of plastic deformation, role of dislocation, slip and twinning, slip mechanism, strain hardening.

UNIT II

Phase Diagrams, Phases, phase rules, concept of equilibrium, Phase diagram, lever rule, eutectic, eutectoid, peritectic and peritectoid systems, iron-carbon diagram, and simplified IC diagram. Heat Treatment Isothermal Transformation of austenite(TTT diagram), Transformations of austenite upon continuous cooling, annealing, normalizing, hardening, tempering, hardenability of steel, Surface hardening, tempering, case hardening, Jominy test for hardenability, recovery, recrystallization and grain growth. Age hardening.

UNIT III

Corrosion: Principles of corrosion forms of corrosion, factors affecting the rate of corrosion. Corrosive agents and protection against corrosion.

Creep: Introduction to creep mechanism, creep curves, creep resistant materials, introduction to fatigue, cold working of metals and hot working.

UNIT IV

Engineering Materials

Ferrous: Cast irons, carbon and alloy steels and their coding

Non-ferrous: Aluminum, copper, nickel, chromium, zinc, lead, tin, tungsten, etc. and their alloys.

Classification, structure, general properties and applications of polymers, ceramics and composites.

UNIT V

Powder Metallurgy: Characteristics of metal powder, Particle size, shape and size distribution, Characteristics of powder mass such as apparent density, tap density, flow rate, friction conditions. Properties of green compacts and sintered compacts.

Machining, milling, atomization, electro-deposition, reduction from oxide, carbonyl process, production of alloy powders, New development.

Powder rolling, powder forging, powder extrusion and explosive forming technique.

Recommended Books:

- 1 Raghavan, Material Science and Engineering.
2. Swamp, Elements of Metallurgy
3. Vanlack, Elements of Material Science and Engineering.
4. Aagarwal, B.K Introduction to engineering Materials

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3TPC11 THEORY OF MACHINE

UNIT-I

Basic Concepts: Kinematics of machine, Kinematic link and their different types, types of kinematic pair, kinematic chain, mechanism and inversions of four bar chain and slider crank mechanism. Degree of freedom, synthesis of linkages – number synthesis, Grashof's criterion and introduction to dimensional synthesis. Brief introduction to mechanism with lower pairs, pantograph, Davis & Ackerman's steering mechanism.

UNIT-II

Velocity Analysis: Motion of a link, velocity of a point on a link by relative velocity method, velocities of slider crank mechanisms, rubbing velocity at a pin joint, velocity of a point on a link by instantaneous center method, properties and types of I-Center, Kennedy theorem and methods of locating I-centers in a mechanism.

Acceleration Analysis: Acceleration of a point on a link, acceleration in slider crank mechanism, Coriolis component of acceleration, Quick-return mechanism.

UNIT-III

Gears: Classification of gears, terminology used in gears, law of gearing, velocity of sliding, forms of teeth, construction and properties of an involute, construction and properties of cycloidal teeth, effect of variation of center distance on the velocity ratio of involute profile tooth gears, length of path of contact, arc of contact, number of pairs of teeth in contact, interference, minimum number of teeth, interference between rack and pinion, undercutting, terminology of helical and worm gears.

UNIT-III

Gear Trains: Definition of simple, compound, reverted and epicyclic gear trains, velocity ratio of epicyclic gear trains.

Clutch: Single plate and multi plate clutch, cone clutch.

Brakes: types and analysis by assuming uniform pressure and uniform wear theory, simple brake, band brake, block brake and internal shoe brake.

UNIT-IV

Cams and Followers: Types of cams and followers, Specified motion of followers. Uniform acceleration & deceleration, S.H.M. and uniform velocity Graphical construction of cam-profile.

Turning Moment of Flywheel:

Function of a flywheel, Crank effort diagrams. Fluctuation of speed and energy. Effect of centrifugal tension of flywheel, Inertia torque and its effects on Crank effort diagrams

UNIT-V

Governors: Distinction between function of a flywheel and governor, types of governor, Watt, porter, proell, hartnell governor.

Balancing: Static and dynamic balancing, balancing of several masses in different planes.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

Recommended Books:

1. Bevan T, "*The Theory of Machines*", CBS Publishers and Distributors.
2. Shigley J E and Vickar J J, "*Theory of Machines and Mechanism*", . McGraw Hill, New Delhi.
3. Wilson C and Sadler J, "*Kinematics and Dynamics of Machine*". . Prentice Hall.
4. Ratan S S, "*Theory of Machines*", 1st Edition, Tata McGraw Hill, New Delhi.
5. Rao J S and Dukupati R V, "*Mechanism and Machine Theory*", . New Age International (P) Limited, Delhi.
6. Mechanisms & machines by Ghosh and Mallick, East west Press
7. Theory of machine by Rattan lal T.M.G.H. Publications

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3TPC12 MANUFACTURING PROCESSES-I

UNIT-I

Lathe: Lathe design and terminology Specification, types of Lathe: center lathe, capstan and turret lathe, various operations performed on lathe, operating conditions calculation of material removal rate.

Drilling: Fundamental of drilling process, types of drilling machine, types of drills, geometry of twist drill, various operations performed on drilling machine.

Milling: Introduction, types and processes, Milling cutters, up and down milling, different operations on milling, indexing and types, calculation of MRR.

Boring: Introduction to boring, reaming, tapping and taps, other hole making operations.

UNIT-II

Broaching: Introduction, Machines and processes.

Grinding: Classify grinding machines, constructional features and working of various grinding and super-finishing machines.

Honing, lapping, buffing & super-finishing processes with their applications.

Threads Manufacturing: Introduction, thread production processes and machines.

UNIT-III

Planning: Introduction, different operations and calculation of MRR.

Gear Manufacturing: Introduction to gear cutting process, gear forming, gear shaping, gear hobbing and gear finishing along with inspection.

Forming: Mechanism of forming process, elastic and plastic deformation.

UNIT-IV

Rolling: Classification, theories of Hot & Cold rolling, rolling mills & its types, two-hi, four-hi, six-hi and twenty-hi rolling mill, calculation of rolling parameter & rolling defect.

Forging: Classification of forging process, forging equipments, calculation of forging parameters, forging defects.

Extrusion: Types, extrusion equipments & analysis of processes, drawing of rods, wire & tube and their analysis, defects in extrusion & drawing.

UNIT-V

Work Holding Device: Introduction to jigs and fixtures their types, design criteria for jigs and fixtures, economic justification of jigs and fixtures.

Plastic Working: Plastic processing, injection, compression & blow moulding, plastic design principles processes, machines and equipments, parameters and force calculations.

Recommended Books:

1. Raghavan, Material Science and Engineering.
2. Swamp, Elements of Metallurgy
3. Vanlack, Elements of Material Science and Engineering.
4. Agarwal, B.K Introduction to engineering Materials.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH III SEMSTER

IP3LPC11 THEORY OF MACHINE LABORATORY

1. Study of Gyroscopic effect and determination of gyroscopic couple.
2. Determination of jump speed of cam-follower system.
3. Dynamic balancing of the rotating mass system.
4. To determine radius of Gyration "K" of given pendulum.
5. To study the free vibration and to determine the natural frequency of vibration of Tow-Rotor system. 6. To study the torsional vibration and to determine the natural frequency vibration of single rotor system.
6. Study of longitudinal vibration and to determine the frequency of vibration.
7. To study the damped torsional vibration and determine the damping coefficient.
8. To verify the relation $T = 2\pi\sqrt{l/g}$ for a simple pendulum.
9. Determination of whirling speed of shafts.

IP3LES11 STRENGTH OF MATERIALS LABORATORY

1. Determination of Young's modulus, tensile, strength and percentage elongation for steel, aluminum, brass and cast iron specimens on universal testing machine. Also plot the stress strain diagram.
2. To perform the compression test for cast iron specimen on universal testing machine.
3. To determine the deflection for mild steel specimen and verify the beam formula for specimen in bending.
4. To determine the stiffness of the following:
(i) Cantilever beam (ii) Spring under compressive and tensile loading
5. To measure the total energy absorbed in fracturing of the ductile specimen on Charpy and Izod setup.
6. To plot and study the S-N curve for steel, aluminum and fibre reinforced composite material at 25%, 50%, 60% and 75% of ultimate tensile strength of the specimen.
7. Preparation of specimen for hardness test.
8. Testing of prepared specimens for Brinell hardness and Rockwell hardness.
9. To study the behavior of steel and aluminum specimen under torsion.

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Department of Industrial and Production Engineering



INSTITUTE OF TECHNOLOGY
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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
STUDY & EVALUATION SCHEME
W.E.F. SESSION 2016-2017

Year: B.Tech. II year
SEMESTER-IV

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP4TPE1..	Elective-PE-1	3	0	0	40	60	100	3
2.	IP4TBS02	Numerical Analysis and Computer Programming	3	1	0	40	60	100	4
3.	IP4TPC21	Machine Drawing	3	0	0	40	60	100	3
4.	IP4TPC22	Industrial Engineering	3	0	0	40	60	100	3
5.	IP4TPC23	Manufacturing Processes-II	3	0	0	40	60	100	3
6.	IP4TPC24	Fluid Mechanics	3	1	0	40	60	100	4
Total			18	02		240	360	600	20

PRACTICALS									
1.	IP4LPC21	NACP	-	-	03	45	30	75	2
2.	IP4LPC24	Fluid Mechanics	-	-	03	45	30	75	2
Total					06	90	60	150	04

Elective-Professional Elective (PE)-I	
S.N.	IP4TPE1..
11.	Occupational Health and Safety
12.	Business communication and presentation skill
13.	Business ethics and corporate governance

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH IV SEMSTER

IP4TBS02 NUMERICAL ANALYSIS & COMPUTER PROGRAMMING

UNIT-I

Approximation and errors in Computation

Approximation and round of errors, truncation errors and Taylor series, Determination of roots of polynomials and transcendental equations by Graphical methods and Bisection, Regula-falsi, secant and Newton-Raphon methods, solution of Linear simultaneous, linear algebraic equations by gauss Elimination Gauss-Jordan and Gauss-Siedel iteration method.

UNIT-II

Empirical Laws, Curve Fitting & Interpolation

Curve fitting linear and non-linear regression analysis (Method of group average and least squares) finite differences, backward, forward and central difference relation and their use in Numerical differentiation and integration and their application in interpolation.

UNIT-III

Numerical Solution of Ordinary Differential Equations

Numerical Integration by Trapezoidal rule, Simpson's (1/3rd & 3/8th) rule and its error estimation. Application of difference relations in the solution of partial differential equations. Numerical solution of ordinary differential equations by Taylor's series, Euler, modified Euler, Runge-Kutta and Predictor-Corrector method.

UNIT-IV

Numerical Solutions of partial differential Equations

Introduction, classification of second order equations, finite difference approximations to partial derivatives, elliptic equations, solution of Laplace equation, solution by Poisson's equation, solution of elliptic equations by relaxation method, parabolic equations, solution of one-dimensional heat equation, solution of two-dimensional heat equation, Hyperbolic equations, solution of wave equation.

UNIT-V Computer Programming

I/O Statement, Mathematical Relational & Conditional statement & Expressions. Switch Loops and Control Statement. Introduction to one dimensional array and two dimensional arrays. Basic of I/O file Handling.

Recommended Books:

1. Numerical Methods in Engineering & Science-Dr. B.S.Grewal-Khanna Publishers.
2. Numerical Methods-P.Kandasamy,K.Thilagavathy & K. Gunavathy-S Chand & Co.
3. Let us C-Yashwant kanitkar
4. Introductory Methods of Numerical Analysisi-S.S.Sastry,3rd Edn.-PHI-New Delhi.
5. Numerical Methods Analysis-James B.Scarborough, Oxford, & IBH Publishing Co.- New Delhi.
6. Theory & Problem in Numerical Methods-T Veerarajan,T. Ramchandran- TMH.
7. Numerical Methods for Engineers-Steven C. Chapra,Raymond P. Canale.
8. The Spirit of C-Henry Mullish & Herbert L.Cooper-Jaico Pub. House.



DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH IV SEMSTER

IP4TPC21 MACHINE DRAWING

Unit-I

Drawing conventions, sectional views and sectioning, representation of machine parts such as external and internal threads, slotted heads, square ends, and flat radial ribs, slotted shaft, splined shafts, bearings, springs, Convention of gears in mesh, representation of geometrical tolerances on drawings.

Unit-II

Rivet heads and riveted joints: Lap and butt joint with single and double straps,
Welding joints and their representation, symbols of different joint.
Machining symbols, Surface roughness, grades, material symbols.

Unit-III

Screw thread and screw fastening, different types of thread profile and nuts, bolts,
Sectional views: keys, cotter joints, knuckle joints
Shaft coupling, flanged coupling, different types of shaft coupling.
Shaft bearing, bushed bearing, plumber block, foot step bearing.
Pulleys: fast & loose pulleys, stepped pulley's belt pulley, rope pulley.

Unit-IV

Assembly drawing of Engine parts like piston, stuffing box, cross-heads, eccentrics, connecting rod;
Assembly drawing of stop valve, feed check valve, safety valve, blow off cock.
Assembly drawing of lathe tail stock post.

Unit-V

Concept of computer aided drafting(CAD), implementation of CAD, atleast five projects from the above specified topics using CAD software.

Recommended Books:

1. Shigley J.E; Machine Design; TMH
2. Sharma and Parohit; Design of Machine elements; PHI
3. Wentzell Timothy H; Machine Design; Cengage learning
4. Mubeen; Machine Design; Khanna Publisher
5. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
6. Sharma & Agarwal; Machine Design; Kataria & sons
7. Maleev; Machine Design.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH IV SEMSTER

IP4TPC22 INDUSTRIAL ENGINEERING

Unit-I Introduction

History & Development of industrial engineering, Productivity definition; means of increasing productivity; work study definition; productivity and work study; Human factor in the fabrication. Work of F.W. Taylor; Frank and Lillian Gilberth and their contribution.

Unit-II Method Study

Definition & basic procedure, selection of jobs, recording technique; micro motion, study; Therbligs; cyclograph and Chronocyclo-graph; principle of motion economy; design of work place layout; analysis in the form of chart; operation chart; flow process chart; flow diagram; string diagram; man machine chart; two hand chart; Simo chart.

Unit-III Work Measurement

Definition, objectives, application, number of cycle to be timed, time study equipment; performance rating; allowances; number of cycle to be studied; determination of standard time; predetermined motion time systems. Conducting work sampling study & establishing standard time.

Unit-IV Wages & Incentives

Characteristics of a good wage or incentive system, method of wage payment. Concept of wage incentive schemes; financial and non financial; Taylor differential piece rate, Halsey premium plane; Merrie's multiple piece rate system. Group incentive scheme.
Ergonomics, work space dimension, design of work place, environmental stresses & impacts on human work.

Unit-V

Value engineering: Introduction, concept of value, value analysis approaches, job plan, value tests.
Industrial safety, analysis of cost of accident, horzards in various fields like fire, electrical shocks, chemical, organization for safety, plant safety, govt. legistion for safety, safety rules.

Recommended Books:

1. I.L.O., "Introduction to work study", Oxford Press.
2. Mundel, "Motion and time study", Prentices Hall India.
3. Ralph M. Barnés, "Motion and Time Study", John wiley and sons.
4. Industrial Engineering by M.I.Khan, New Age International Publication

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH IV SEMSTER

IP4TPC23 MANUFACTURING PROCESSES-II

UNIT -I

Foundry:

Molding method and materials, Sand-clay-water system, Additives, pattern making and types, Pattern allowances & design considerations, types of molding sand & their properties, testing, cores and sand core boxes, core making, molding machine, Elements & design of gating system.

Melting furnaces and practices: Melting cast iron, steel and non ferrous material, cupola, charge calculation, open furnaces, converter and crucible furnaces, electric, direct arc furnace, inductive furnace.

UNIT -II

Casting: Introduction to pattern and its types, allowances, Centrifugal and investment casting, shell, plastic and mould methods, melting of cast iron, element of gating system, types and design of riser, solidification of casting, clearing of casting, principle of die casting, gravity and pressure die Casting, Die casting consideration, casting defects,

UNIT -III

Welding: Classifications, principle and equipments, different type of welding process and their equipments, features, Arc Welding, Resistance welding, TIG, MIG, Submerged arc welding, friction welding, soldering, brazing and adhesive bonding, Welding defects.

UNIT -IV

Sheet -metal working: Role of sheet metal components, Cutting mechanism, Description of cutting processes like blanking, piercing, lancing etc. Description of forming processes like bending cup drawing, coining, embossing etc. Basic elements of Presses for sheet metal working. Part feeding systems, Punch and die clearances, die elements.

UNIT -V

Non-conventional machining: Introduction, Classification and comparison of different non-conventional machining, theory and analysis, basics, and MRR of EDM, ECM, LBM, AJM, ECG, EBM.

Recommended Books:

1. Rao, P.N., Manufacturing Technology vol.1 TMGH
2. Ghose and Mallick, Manufacturing Science, East West Press
3. Roy, A. Lindberg, Material and Process of manufacturing, PHI
4. Serope Kalpakjian, Manufacturing Engineering & Technology, Pearson.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH IV SEMSTER

IP4TPC24 FLUID MECHANICS

Unit-I

Review of Fluid Properties: Engineering units of measurement, mass, density, specific weight, volume and gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapor pressure. Fluid Static's : Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and tainter gates); buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Unit-II

Kinematics of Flow : Types of flow-ideal & real, steady & unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow nets their utility & method of drawing flow nets.

Unit-III

Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow, momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications.

Flow Measurements: Velocity measurement (Pitot tube, Prandtl tube, current meters etc.), flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venture-meter, weirs and notches).

Unit-IV

Dimensional Analysis and Dynamic Similitude: Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, rotodynamic machines etc.).

Unit-V

Laminar Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles.

Turbulent Flow: Basics of turbulence, Reynolds stresses, Prandtl's mixing length hypothesis, friction velocity, law of walls.

Recommended Books:

1. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
2. Som and Biswas; Fluid Mechanics and machinery; TMH
3. Cengel; Fluid Mechanics; TMH
4. White; Fluid Mechanics; TMH
5. JNIK DAKE; Essential of Engg Hyd; Afrikan Network & Sc Instt. (ANSTI)
6. Franiss JRD; A Text Book of fluid Mech. for Engg. Student
7. R Mohanty; Fluid Mechanics; PHI
8. Gupta; Fluid Mechanics; Pearson.



DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH IV SEMSTER

IP4TPE11 OCCUPATIONAL HEALTH AND SAFETY (Elective)

UNIT-I

Introduction: Environmental law: Legal control of Hazardous substances and processes, Environmental Issues and judicial trends. Health and safety law, common liabilities and work place injuries, Health and safety at work- the principle legal requirements, Health and safety and Industrial relation law.

UNIT-II

Health and safety Management: Safety Management and policy, Investigation reporting and recording of accidents, Health and safety monitoring, Comprehensive exposure assessment, Principles of evaluating workers exposure, Risk assessment in the work place, Major incidents and procedures, Health and safety training and communication, the cost of accidents. Principles of accident prevention, safe system of work, Surveys and audits.

UNIT-III

Occupational Health and Hygiene: The organization of working environment, temperature, lighting and ventilation, welfare amenity provision, cleaning and hygiene. Toxicology and health, Occupational disease and conditions: Occupational Audiometry, NIHL, Cardiovascular Disease, Physiological and psychological parameters, Occupational health practice, Noise and vibration, Dust and fumes, radiation and radiological protection, personal protection, Occupational hygiene practice, prevention and control strategies in occupational hygiene, manual handling, first aid, human factor and safety, stress, safety technology.

UNIT-IV

Assessment of Exposure: Measurement of noise and vibration exposure. Noise and vibration and control, Heat stress monitoring, dust exposure and respiratory health. Work Posture, Musculoskeletal disorders, Strain Index, Lifting Equation, Maximum acceptable weight limits, Occupational Audiometry, Cardiovascular health, Occupational determinants of heart rate variability, pulmonary functions and respiratory health

UNIT-V

Government schemes and norms related to health and nourishment, Policies of government in special context to Chhattisgarh state

Recommended Books:

1. Jeremy W. Stranks, "Handbook of Health and safety Practice" Pitman Publishing.
2. Dharmendra S Sengar, " Environmental law" Prentice Hall of India, New Delhi.
3. Malcolm J Crocker, "Noise and Noise Control" CRC Press.
4. Marek Malik, " Clinical Guide to cardiac Autonomic Tests" Kulwer Academic Publishers.
5. Marek Malik, "Hear rate variability" Futura Publishing Co. NY
6. Cyril M Harris, "Handbook of Noise control" McGraw-Hill Book Company, NY
7. Maryanne Maltby, "Occupational Audiometry" Butterworth-Heinemann Imprint of Elsevier.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH IV SEMSTER

IP4TPE12 BUSINESS COMMUNICATION AND PRESENTATION SKILL (Elective)

Unit - I

Business communication covering, Role of communication in information age; concept and meaning of communication; skills necessary for technical communication; Communications in a technical organization; Barriers to the process of communication and so on

Unit -II

Style and organization in technical communication covering, Listening, speaking, reading and writing as skills; Objectivity, clarity, precision as defining features of technical communication; Various types of business writing: Letters, reports, notes, memos; Language and format of various types of business letters; Language and style of reports; Report writing strategies; Analysis of a sample report

Unit -III

Communication and personality development covering, Psychological aspects of communication, cognition as a part of communication; Emotional Intelligence; Politeness and Etiquette in communication; Cultural factors that influence communication; Mannerisms to be avoided in communication; Language and persuasion; Language and conflict resolution;

Unit -IV

Language Laboratory emphasizing Listening and comprehension skills; Reading Skills; Sound Structure of English and intonation patterns;

Unit -V

Oral Presentation and professional speaking covering, Basics of English pronunciation; Elements of effective presentation; Body Language and use of voice during presentation; Connecting with the audience during presentation; Projecting a positive image while speaking; Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Basics of public speaking; Preparing for a speech;

Recommended Books:

1. Fred Luthans, *Organizational Behaviour*, McGraw Hill
2. Lesikar and petit, *Report writing for Business*
3. M. Ashraf Rizvi, *Effective Technical Communication*, McGraw Hill
4. Wallace and masters, *Personal Development for Life and Work*, Thomson Learning
5. Farhathullah, T. M. *Communication skills for Technical Students*
6. Michael Muckian, John Woods, *The Business letters Handbook*
7. Herta A. Murphy, *Effective Business Communication*
8. *MLA Handbook for Writers of Research Papers*

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH IV SEMSTER

IP4TPE13 BUSINESS ETHICS AND CORPORATE GOVERNANCE(Elective)

UNIT-I

Introduction: Corporation, 'definition and characteristics, history of corporate form and models, corporate objectives, corporations and government, governance, corporate governance, definition, perspectives.

UNIT-II

Theoretical Foundations of Corporate Governance: Notion of conflict of interest, property rights theory, nexus of contracts, agency theory, Berle and Means' theory, concept of separation of ownership and control, shareholder, stakeholder debate.

UNIT-III

Pillars of Governance in Organizations: Owners, ownership structure, types of owners, ownership vs. control, board of directors, types of directors, board roles and board attributes, board committees, executive management, role of CEO, succession planning, managerial myopia, institutional investors, types, categories, features and role.

UNIT-IV

Work Ethos: Values and ethics, model of management in the Indian socio, political environment, need for values in global change, Indian perspective, values for managers, holistic approach for managers in decision making.

UNIT-V


Business Ethics and CSR: Corporation as a social institution, accountability and sustainability, relevance of triple bottom line reporting to CSR, codes of conduct, applications of ethical theories to decision making, ethical issues related to employment, healthcare and advertisement.

Recommended Books:

1. Praveen B. Malla, Corporate Governance: Concept, Evolution and India Story, Routledge, 2010.
2. Sadri, Business Ethics: Concepts and Cases, Tata McGraw Hill, 1998.
3. Robert Monks, Nell Minow, Corporate Governance, Wiley Publications, 2009.

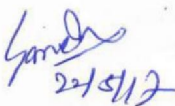
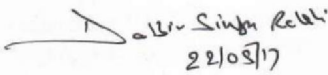

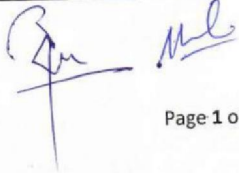
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INSTITUTE OF TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA
 (A CENTRAL UNIVERSITY ESTABLISHED BY THE CENTRAL UNIVERSITY
 ORDINANCE 2009, NO: 3 OF 2009)
DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
STUDY & EVALUATION SCHEME
W.E.F. SESSION 2017-2018
Year: B.Tech. III year
SEMESTER-V

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP5TPC31	Metal Cutting	3	0	0	40	60	100	3
2	IP5TPC32	Fluid Machinery	3	0	0	40	60	100	3
3	IP5TPC33	Machine Design- I	3	0	0	40	60	100	3
4	IP5TPE2..	Elective-PE2	3	0	0	40	60	100	3
5	IP5TPE3..	Elective-PE3	3	0	0	40	60	100	3
6	IP5TOE1..	Elective-OE1	3	0	0	40	60	100	3
Total			18	0		240	360	600	18
PRACTICALS									
7.	IP5LPC31	Metal Cutting	-	-	03	30	20	50	2
8.	IP5LPC32	Fluid Machinery	-	-	03	30	20	50	2
9.	IP5LPC33	SEMINAR			03	50		50	2
Total					09	110	40	150	06

Elective-Professional Elective (PE)-2		Elective-Professional Elective (PE)-3		Elective- Open Elective (OE)-1	
S.N.	IP5TPE...	S.N.	IP5TPE...	S.N.	IP5TOE...
21.	Turbo Machines	31.	Total Quality Management	11.	Financial Management
22.	I.C. Engine	32.	Industrial Automation	12.	Managerial Economics
23.	MEMS and Nanotechnology	33.	Mechatronics	13.	Financial Accounting and Costing

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 Dalbir Singh Redi: 22/05/17
 Anurag 22/5/17
 M. L.
 Page 1 of 18



NIT-I

Basic concepts - Definition and classification of metal cutting and tools, geometry of single point and multipoint cutting tools, and various angles of cutting tools and their functions, factors affecting tool geometry, Cutting tools nomenclature system, orthogonal and oblique cutting, cutting tool signature.

Types of chips- continuous, discontinuous and serrated built up-edge and their formation and factors.

UNIT-II

Principal of metal cutting - Elements of machining, mechanism of chip formation, forces on the chips, merchant theory and other theories of metal cutting, stresses and strain in chips, shear and strain rate, power and energy calculation.

Theory of multipoint machining- mechanism of drilling, machining time, torque and thrust, power calculation in drilling, milling, and broaching

UNIT-III

Heat generation and cutting temperature in machining- causes and sources of heat in cutting, heat distribution, their measurement, tool dynamometer and their types and working.

Cutting fluids- functions characteristics and types of cutting fluids and their application, criteria for selection of cutting fluids.

Cutting tool materials- requirements types and characteristics of various cutting tool materials, comparison and selections of cutting tools.

UNIT-IV

Tool failures and tool life - mechanism of tool failure, types of tool failure, tool wear and types, tool life and its measurement, Taylor's tool life equations, relationship between tool life cutting speed, feed, depth of cut, factors affecting tool life

Control of chips and chip breakers - methods of chip breaking, design principle of simple step type chip breakers. Working principle of chip breakers, effect of chip breaking.

UNIT-V

Machinability - definitions, evaluations, factors affecting machinability, machinability index.

Economics of machining - cost analysis and optimization of machining, various parameters for calculation of machining cost.

Text Books:

1. Manufacturing Technology Vol.-II P.N. Rao PHI
2. Manufacturing Science, Ghosh Mallick, E.W.P.

Dr. V. Singh Reddy

Divyanshu

Sandeep

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4. Production Technology- Degarmo, P.H.I.
5. Text Book of Production Engineering- K.C. Jain & Chitale, P.H.I.
6. Machining & M/C Tools- A.B.Chattopodhyay- Willey

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UNIT - I

Boundary Layer Theory: Boundary Layer Definition and Characteristics, Momentum Equation, Laminar and Turbulent Boundary Layer, Total Drag, Separation and Control.

Flow Around Submerged Bodies: Force Exerted by Flowing Fluid on a Body: Drag and Lift; Stream Lined and Bluff Body, Drag on Sphere and Cylinder, Circulation and Lift on Circular Cylinder, Lift of an Air Foil.

UNIT - II

Impact of Free Jets: Impulse Momentum Principle, Force Exerted by the Jet on Stationary Flat and Curved Plate, Hinged Plate, Moving Plate and Moving Curve Vanes, Jet Propulsion of Ship.

Impulse Turbine: Classification of Turbine, Impulse Turbine, Pelton wheel, Construction Working, Work Done, Head Efficiency and Design Aspects, Governing of Impulse Turbine.

UNIT - III

Reaction Turbine Radial Flow Reaction Turbine, Francis Turbine: Construction, Working, Workdone, Efficiency, Design Aspect, Advantages & Disadvantages over Pelton Wheel.

Axial Flow Reaction Turbine: Propeller and Kaplan Turbine, Bulb or Tubular Turbine, Draft Tube, Specific Speed, Unit Quantities, Cavitation, Degree of Reaction, Performance Characteristics, Surge Tanks, Governing of Reaction Turbine.

UNIT-IV

Centrifugal Pumps: Classification of Pumps, Centrifugal Pump, Construction, Working, Work Done, Heads, Efficiencies, Multistage Centrifugal Pump, Pump in Series and Parallel, Specific Speed, Characteristic, Net Positive Suction Head, Cavitation.

UNIT - V

Reciprocating Pumps: Classification, Component and Working, Single Acting and Double Acting, Discharge, Work done and Power Required, Coefficient of Discharge, Indicator diagram, Air Vessels.

Fluid system: Hydraulic Accumulator, Hydraulic Intensifier, Hydraulic Press, Hydraulic Crane, Hydraulic Lift, Hydraulic Ram, Hydraulic Coupling, Hydraulic Torque Converter, Air Lift Pump, Jet Pump.

Text Books:

1. Mechanics of Fluid - Massey B.S. - English Language Book Society (U.K.)
2. Introduction to Fluid Mechanics and Fluid Machines - S.K. Som & G. Biswas - TMGH
3. "Fluid Mechanics & Machinery" by Agarwal, TMGH.
4. "Fluid Mechanics & Machinery" by Kothandraman & Rudra Mourthy, New Age Publication.

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5. Experiment in Hydraulics & Hydraulic M/C- Shesha Prakash- PHI
6. Fluid Mechanics & Turbo M/C- Das- PHI
7. Fundamentals of Turbo M/C- Venkanna- PHI
8. Introduction to Hydraulics & Pneumatics- Ilargo & Soundarajan- PHI

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UNIT-I

Steady stresses and variable stresses in machine member-introduction to the design process factors influencing machine design, selection of material based on mechanical properties, direct, bending and torsional stress equation, impact and shock loading, calculation of principle stresses for various load combination, eccentric loading, design of curved beams, crane hook and 'c' frame, factor of safety, theories of failure, stress concentration, fatigue design for variable loading, Soderberg, Goodman and Gerber relations.

UNIT -II

Riveted joints - failure of riveted joint, strength and efficiency of riveted joint. Design of butt and lap joint for a boiler, eccentrically loaded riveted joint.

Design of thread joints, bolted joint in tension, torque requirement for bolt tightening, bolted joint under fluctuating load. Eccentrically loaded joint in shear, bolted joint with combined stresses.

UNIT-III

Design of cotter and knuckle joints, socket and spigot cotter joint, sleeve and cotter joint Gib and cotter joint, design of knuckle joints.

Welded joints- stresses in butt and fillet welds, strength of welded joints, eccentrically loaded joint, welding joint subjected to Bending moment.

UNIT-IV

Design of Keys and coupling, flat and square keys, woodruff keys, splines, muff coupling, compression coupling, flange coupling, flexible coupling.

UNIT -V

Design of shafts: subjected to twisting moment, bending moment, combined twisting moment and bending moment, fluctuating loads, design of shaft on the basis of rigidity.

Text Books:

1. Machine Design-Bhandari, TMH
2. Machine Design:Spott, TMH
3. Machine Design: J.Shigley, TMH
4. Machine Design: Khurmi & Gupta, Khanna Publisher.
5. M/C Design- Sharma & Agrawal, Dhanpat Rai Publications.
6. Design of M/C Elements- Sharma & Purohit- PHI

Dr. Singh

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IP5TPE21 - Turbo Machinery

UNIT-I

Nozzles & Diffuser: Nozzles & Diffuser types, their efficiency, critical pressure & velocity, relationship between area, velocity & pressure in nozzles flow.

Steam Turbine Types: Steam turbine-principal of operation of steam turbine, types, impulse turbine, compounding of steam turbine pressure compounded velocity compounded and pressure-velocity compounded impulse turbine.

Velocity diagram for impulse turbine: Force on the blade and work done, blade or diagram efficiency, gross stage efficiency, influence of ration of blade to steam speed on blade efficiency in a single stage impulse turbine, impulse blade section, choice of blade angle.

UNIT -II

Impulse-reaction turbine: Velocity diagram, degree of reaction, Impulse-Reaction turbines with similar blade section and half degree of reaction (parson's turbine) Height of reaction, blade section.

Energy losses in steam turbine-internal and external losses in steam turbine.

UNITS -III

State points Locus & Reheat factors: Factor-stage, efficiency of impulse turbine, stage point locus of an impulse turbine, state point locus for multistage turbine reheat factor. Internal efficiency, overall efficiency, relative efficiency, Design procedures of impulse & impulse reaction turbine.

Governing of steam turbine: Throttle governing, nozzle governing, bypass governing, combination of throttle and nozzle, governing and combination of bypass and throttle governing. Effect of governing on the performance of steam turbine.

UNIT -IV

Gas turbine: Classification of Gas turbine, simple open cycle gas turbine, ideal and actual (Brayton cycle) for gas turbine. Optimum pressure ratios for maximum specific output in actual gas turbine, Regeneration, reheat and inter cooling and effect of these modification on efficiency and output, closed cycle gas turbine.

UNIT -V

Turbo compressors: Introduction, classification of Centrifugal Compressor- Component working, velocity diagram, calculations of power and efficiencies. Slip factor, surging and choking, power and efficiencies.

Axial Flow Compressor: Construction and working, velocity diagram, calculation of power and efficiencies, Degree of reaction, work done factor, stalling, comparison of centrifugal and axial flow compressor.

D. K. Singh RSCS
/m/

Dr. B. K. Singh
22/05/14

R. K. Singh
/m/



Books:

1. Steam and Gas Turbine – R. Yadav by C.P.H. Publication, Allahabad.
2. Turbine, Compressors and Fans – S.M. Yahya – TMH.
3. Gas Turbine – V. Ganeshan – TMH.
4. Fundamentals of Turbo Machinery- Venkanna, PHI.

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IP5TPE22 - Internal Combustion Engine

UNIT-I

Introduction of internal combustion engines, classification of I.C. engines, engines components, basic engine nomenclature, four stroke S.I. and C.I. engine, two stroke engines, comparison of two stroke and four stroke engines, comparison of S.I. and C.I. engines, application of IC engines.

Air Standard Cycle: Otto cycle, diesel cycle, dual cycle, comparison between otto, diesel and dual cycles, fuel-air cycles and actual-cycles, effect of variable specific heats and dissociation on indicator diagram.

UNIT-II

Combustion in S.I. Engines: Flame development and its propagation, ignition lag, effect of engine parameters on ignition delay, preignition, knocking in S.I. engines, variables affecting knock, combustion chambers.

Carburetor: Principle of carburetion, elements of carburetor, parameters affecting carburetion, air-fuel mixtures, expression for air-fuel ratio.

Fuel Ignition System: Battery and coil ignition system, magneto ignition system, firing order, spark advancing.

Combustion in S.I. Engines: Flame development and Propagation, ignition lag, effect of air density, temperature, engine speed, turbulence, and ignition timings, physical and chemical aspect of detonation, effect of engine and fuel variable on knocking tendency, knock rating of volatile fuels, octane number, H.U.C.R., Action of dopes, pre-ignition, its causes and remedy, salient features of various types of combustion chambers, valve timing and firing order.

UNIT-III

Combustion in C.I. Engines: Combustion phenomenon in C.I. engines, p- v diagram and their study for various stage of combustion, delay period, detonation in C.I. engines, parameters affecting detonation.

Fuel Injection System: Air and solid injection, fuel pump and injectors.

UNIT-IV

Engine Friction and Lubrication: Total engine friction, blow by losses, pumping losses, factors effecting engine friction, mechanism of lubrication, lubrication system.

Cooling System: Piston and cylinder temperature distribution, parameters affecting engine heat transfer, principles and various methods of cooling.

Two Stroke Engine: Constructional details, scavenging parameters, models and performance of scavenging system, advantages and disadvantages of two stroke engines.

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IT- V

Supercharging: effect of altitude on mixture strength and output of SI engines, low and high pressure supercharging, exhaust, gas turbo-charging, supercharging of two stroke engines.

Engine friction and lubrication, Engine cooling system.

Text Books:

1. Mathur M.L. and R.P. Sharma, A Course in IC Engines, Laxmi Publication.
2. Ganesan.V, Internal Combustion Engines, TMGH Publication.
3. Taylor G.F., Internal Combustion Engines: Theory and Practice.
4. Stone, Richard, Introduction to IC Engine
5. Fundamentals of I.C. Engine- Gupta, PHI



IP5TPE23 - MEMS and Nanotechnology

UNIT- I

Introduction: Definition of micro electro-mechanical systems (MEMS), micro sensor, micro actuators, microelectronic fabrications, mechanical thermal and magnetic MEMS, radio frequency (RF) MEMS, MOEMS, MEMS design consideration.

Micromachining, photolithography, structural and sacrificial materials, methods of lithography. Thin film deposition, and its developments process, LPCVD, PECVD, impurity doping, etching, problem with bulk micromachining, vapour bonding, LIGA.

UNIT- II

System modelling and properties of material- System types and basic modelling elements in mechanical, thermal, fluid system. Translational and rotational pure mechanical system, hybrid system, analogy between mechanical and electrical system.

Passive components and systems - System on a chip, passive electronics system, passive mechanical system.

UNIT- III

Mechanical sensors and actuators- Introduction, principals, micro plates, capacity impacts, piezoelectric materials, and their properties, MEMS gyroscope.

Thermal sensor and actuators - Introduction, thermocouple probe, micro hot plate gas sensors, mems thermo vessels, shape memory alloys.

UNIT- IV

Magnetic sensors and actuators- Different types and principals.

RF MEMS -Introduction, RF based communication system, MEMS inductors, and tuner filter, Resonator.

UNIT-V

NANOTECHNOLOGY - Introductions, nanotechnology materials, fullerenes, doping, CNT, SWCNT, MWCNT, development and application of CNT.

Text Books:

1. MEMS- Mahalik- McGrawHill.
2. MEMS & MOEMS Technology & Application- Rai Choudhary, PHI.

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IP5TPE31 - Total Quality Management

UNIT - I

Basic concepts of Quality: Inspection definition of quality, quality control cost of quality, Value of quality, Statistical Quality Control, Need and advantages of SQC

Frequency Distribution: Variables & attributes, quality characteristics, Theory of control charts, control chart for variable X & R chart, Control chart for attribution p, np, C, Chart & process capability

UNIT - II

Quality Assurance: Quality assurance Manual, Quality Circle, characteristics of quality circle and the process of operation of quality circle, quality Policy & procedure & objectives.

Acceptances Sampling: Concept of sampling, O-C curve & its construction, Sampling plans, single, doubles & multiple sampling plans.

UNIT - III

Contribution of Various Quality Management Gurus: Juran Trilogy, Deming's 14 Points, P-D-C-A Wheel, Taguchi's philosophy, Design of experiment, old and new Seven QC Tool of Quality, Philip Crosby's zero defect, seven types of waste, 5's, Quality function deployment

UNIT - IV

Introduction to ISO 9000: Various models of ISO 9000, Clauses of 9000, Total Quality Control, Total Quality Management, Tool for TQC & TQM, Kaizen. 6 sigma quality, procedure of six sigma, TQM and Six Sigma

UNIT - V

Reliability: Definitions, Bathtub curve, design for reliability, Failures & causes of failures, FMECA, Maintainability & Availability, MTBF, Reliability Models, system with components in series & in parallel, mixed arrangement, fault -tree-technique.

Text Books:

1. SQC by Grant & Leowowworth - Tata Mc. Hill
2. Quality Planning & Analysis by Juran & Gryana - Tata Mc. Hill
3. Total Quality Control By A. Feigenbaum - Mcgraw Hill
4. SQC by M.Mahajan - Dhanpat rai publication
5. Total Quality Management - Besterfield Tata Mc. Hill
6. Total Quality Management - Purnima charantimath (LowPearson Education)
7. Total Quality Management - Krishnaiya-PHI
8. Total Quality Management - Suganthi & Sannuel-PHI

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IP5TPE32 - Industrial Automation

UNIT-I

Automation: Definition; Automation in production systems; Automation principles and strategies; Basic elements of an automated system; Advanced automation functions; Levels of automation; Types of automation; Benefits and Impact of Automation in Manufacturing and Process Industries. Architecture of Industrial Automation Systems.

UNIT -II

Pneumatic Control Systems: Overview of different types of valves and Actuators in Pneumatics, their applications and their ISO symbols. Design of Pneumatic circuits using Cascade method and Shift register method (up to 3 cylinders). Design of Electro-Pneumatic Circuits using single solenoid and double solenoid valves with and without grouping. Design of Pneumatic circuits using PLC Control (ladder programming only and up to 3 cylinders) with applications of Timers and Counters and concept of Flag and latching.

UNIT -III

Hydraulic Control Systems: Overview of different types of valves, Actuators and Accumulators used in Oil hydraulic circuits, their applications and their ISO symbols. Basic hydraulic circuits involving linear and rotary actuators (No sequential circuits).

Fundamental concepts of digital and servo hydraulic controls. Comparison between proportional, digital and servo hydraulic control systems.

Digital logic: Number systems; Logic Gates; Boolean Algebra, Simplification of Boolean equations using Karnaugh Maps.

UNIT -IV

Microprocessors and Microcontrollers (Only basic understanding and applications) : Concept of Microprocessor based control and its application; Parts of a Microprocessor system with block diagram of the general form of a microprocessor system; Data bus, Address bus and Control Bus; General internal Architecture of a Microprocessor; Functions of constituent parts such as ALU, Various Registers and the Control unit. Difference between a Microprocessor and a Microcontroller. General Block diagram of Microcontroller.

UNIT-V

Sensors and Transducers: Fundamentals of displacement, position and Proximity Sensors; Velocity and Motion Sensors; Force and Fluid Pressure Sensors; Liquid level and Flow sensors; Temperature and light Sensors; Control of stepper motors.

Text Books:

1. Industrial Production & Automation- Mikel P. Grover, PHI
2. Automation Production System and CIM- Mikel P. Grover, PHI

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IP5TPE33 - Mechatronics

UNIT-I

Introduction to Mechatronics: Sensors and actuators type, selection and interfacing, Digital electronics and microprocessors in Mechatronic systems, Mechatronic systems modeling, Analysis and control of analog, digital and hybrid systems, Mechatronic systems design principles.

UNIT-II

Introduction to Mechatronics Systems: Measurement systems control systems mechatronics approach.

Sensors and Transducers: Introduction performance terminology displacement, position and proximity, velocity and motion, Fluid pressure, temperature sensors, light sensors selection of sensors signal processing

UNIT-III

Microprocessor: Introduction architecture, pin configuration, instruction set, programming of Microprocessor using 8085 instructions, interfacing input and output devices, interfacing D/A converters and A/D converters, applications, temperature control, stepper motor control, traffic light controller.

UNIT-IV

Programmable Logic Controller: Introduction, basic structure, Input/Output processing, programming, Mnemonics, Timers, Internal relays and Counters, Data handling, Analog input/output selection of a PLC.

UNIT-V

Design and Mechatronics: Stages in Designing Mechatronic systems, Traditional and Mechatronic design, possible design solutions, case studies of mechatronic systems, pick and place robot, automatic car park system, engine, management system.

Text Books:

1. HMT Ltd, "Mechatronics", Tata McGraw Hill Publishing Co.Ltd.,1998
2. Bradley D.A., Dawson D., Burn N.C. and Loader A.J., "Mechatronics", Chapman and Hall, 1993.
3. Gaonkar Ramesh S."Microprocessor Architecture, programming and Applications", Wiley Eastern, 1997
4. Mechantronics- Singh & Joshi-PHI

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IP5TOE11 - Financial Management

UNIT -I

Introduction: Scope and objective, organisation of finance function, Time value risk and return and valuation of money, valuation of long term securities various model of pricing.

UNIT -II

Statement of changes in financial position: Sources and uses of working capital ,cash flow statement, balance sheet, profit loss account and its process

Financial ratio analysis: Meaning, types, importance and limitations, calculation of various ratios.

UNIT -III

Capital budgeting: Principals, techniques, various methods of capital budgeting. Concept and measurement of cost and capital, and various approaches for measurement of cost of capital and computation.

Analysis of risk and uncertainty: various approaches for risk evaluation.

UNIT -IV

Theory of working capital management: Concept and definition of gross, working capital and net working capital, trade off between profitability and risk.

UNIT -V

Operating financial and combined leverage: Introduction, definition and concept and various approaches.

Text Books:

1. Financial Management by Khan and Jain, TMGH
3. Financial Management by Kuchhal, Vikas Publication
4. Financial Management- Paresh Shah-Willey India Pvt. Ltd.

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IP5TOE12 - Managerial Economics

UNIT-I

Introduction to Managerial Economics, Different Area of Managerial Economics, Micro and Macro Economics, Nature and Scope of Managerial Economics- Demand Analysis, Law of Demand and its Exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Supply Analysis, Law of Supply, Elasticity of Supply: Definition, Types, Measurement and Significance of Elasticity of Supply.

UNIT-II

Law of Return, Revenue Analysis, Theory of Production and Cost Analysis: Production Function, Cobb-Douglas Production Function, ACMS Production Function, Investment Function.

Cost Analysis: Cost Concept, Opportunity Cost, Fixed Vs Variable Cost, Explicit Costs Vs Implicit Costs, Out of Pocket Costs Vs Imputed Costs. Break-even Analysis (BEA) - Determination of Break-even Point (Simple Problem) - Managerial Significance and Limitation of BEA.

UNIT-III

Introduction to Market & Pricing Policies: Element of Market, Types of Market, Concept of Market, Classification of Market based on the nature of competition, Types of Competition, Features of Perfect Competition, Feature of Imperfect Competition, Monopoly and Monopolistic Competition, Price-Output Determination in case of Perfect Competition and Monopoly.

Objectives and Policies of Pricing: Introduction, Full Cost or Cost plus Pricing, Differential Pricing, Going Rate Pricing, Marginal Cost Pricing, Trade Association Pricing, Loss Leadership Pricing, Administered Pricing

UNIT-IV

Forms of Business Organization: Introduction, Definition, Essential Element of Good Organization, Principles of Organization, Formal and Informal Organization, Organization Structure, Concept of Ownership Organization, Types of Ownership, Partnership, Joint Stock Company, Types of Joint Stock Company, Co-Operative Organization, Public Sector Organization.

Capital and Capital Budgeting: Capital and Its Classifications, Need of Working Capital and Its Assessment, Factors Affecting Working Capital, Fundamental of Accounting, Types of Capital, Method and Sources of Raising Finance, Nature and Scope of Capital Budgeting, Features of Capital Budgeting Proposals, Method of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (Simple Problems).

UNIT-V

Fundamental of Financial Accounting: Nature of Accounting, Important Accounting Terminology, Accounts and Types of Accounts, Rules of Debit and Credit, System of Book Keeping, Book of Accounts, Journal, Ledger, Trial Balance, Final Account, Trading Account, Profit and Loss Accounts and Balance Sheet.

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Financial Analysis Through Ratios: Classification of Financial Ratios, Liquidity Ratios, Leverage Ratios, Activity Ratios, Profitability Ratios, Current Ratio, Acid Test Ratio, Debt Equity Ratio, Assets Coverage Ratio, Debt Service Coverage Ratio, Inventory Turnover Ratio, Debtor Velocity Ratio, Creditor Velocity Ratio, Gross Profit Ratio, Net Profit Ratio, Return on Equity Ratio.

Text Books:

1. Managerial Economics by Yogesh Maheshwari, PHI
2. Managerial Economics By Joel Dean, PHI
3. Managerial Economics By Craig H. Petersen, W. Cris Lewis, Sudhir K Jain
4. Financial Accounting For Management By Ambrish Gupta, Pearson Education
5. Managerial Economics By H. Craig Peterson & W. Cris Lewis, PHI
6. Managerial Economics By Suma Damodaran, Oxford University Press
7. Managerial Economics and Financial Analysis By Aryasri, TMH

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER



INSTITUTE OF TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA
(A CENTRAL UNIVERSITY ESTABLISHED BY THE CENTRAL UNIVERSITY ORDINANCE 2009,
NO: 3 OF 2009)

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
STUDY & EVALUATION SCHEME

W.E.F. SESSION 2017-2018

Year: B.Tech. III year

SEMESTER-VI

S. No	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP6TPC41	Machine Design- II	3	1	0	40	60	100	4
2	IP6TPC42	Measurement , Metrology & Control	3	1	0	40	60	100	4
3	IP6TPC43	Welding Engg.	3	0	0	40	60	100	3
4	IP6TPE4..	Elective-PE4	3	0	0	40	60	100	3
5	IP6TPE5..	Elective-PE5	3	0	0	40	60	100	3
6	IP6TOE2..	Elective-OE2	3	0	0	40	60	100	3
Total			18	2		240	360	600	20
PRACTICALS									
7.	IP6LPC42	Measurement and metrology lab	-	-	03	45	30	75	2
8.	IP6LPC43	Welding Engg. Lab	-	-	03	45	30	75	2
Total					06	90	60	150	04

Elective- Professional Elective (PE)-4		Elective- Professional Elective (PE)-5		Elective- Open Elective (OE)-2	
S.N.	IP6TPE4..	S.N.	IP6TPE5..	S.N.	IP6TOE2...
41.	Material Management	51.	Automobile Engg	21.	Enterprise Resource Planning
42.	Plant Layout & Material Handling	52.	Power Plant Engg	22.	Management Information System
43.	Maintenance And Reliability Engineering	53.	Heat & Mass Transfer	23.	Six Sigma And DOE

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

Note: After the completion of semester exams, students will have to join industrial training of about minimum 4 weeks (5day week and 8 hours a day) in industry. The presentation and report of this will be given in 7th sem during defined schedule by Head of Department. The due credit will be awarded in 7th semester.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPC41- Machine Design-II

UNIT-I

Spring: Spring Materials and Their Mechanical Properties, Equation for Stress and Deflection, Helical Coil Springs of Circular Section for Tension, Compression and Torsion, Dynamic Loading, Fatigue Loading, Wahl Line, Leaf Spring and Laminated Spring.

UNIT-II

Gears : Spur Gears ,Gear Drives, Classification of Gears, Selection of Type of Gears, Law of Gearing, Force Analysis, Gear Tooth Failures, Selection of Material, Number of Teeth, Face Width, Beam Strength of Gear Tooth, Effective Load on Gear Tooth, Estimation of Module Based on Wear Strength, Lewis equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication.

UNIT-III

Helical Gears : Helical Gears, Terminology of Helical Gears, Virtual Number of Teeth, Tooth Proportions, Force Analysis, Beam Strength of Helical Gears, Effective Load on Gear Tooth, Wear Strength of Helical Gears.

Bevel Gears: Bevel Gears, Terminology of Bevel Gears, Force Analysis, Beam strength of Bevel Gears, Wear Strength of Bevel Gears, Effective Load on Gear Tooth.

UNIT-IV

Ball & Rolling Contact Bearings: Types of Ball and Roller Bearings, Selection of Bearing for Radial and Axial Load, Bearing Life, Mounting and Lubrication, Shaft Scales – Contact Type and Clearance Type.

Journal Bearings: Types of Lubrication, Viscosity, Hydrodynamic Theory of Lubrication, Sommerfield Number, Heat Balance, Self-contained Bearings, Bearing Materials.

UNIT-V

Clutches and Brakes: Friction Clutches, Friction Materials, Torque Transmitting Capacity, Single & Multiple Plate Clutch, Centrifugal Clutches. Band and Block Brakes.

Belt Drive: Flat and V-belts, Belt Constructions, Geometrical Relationships for Length of the Belt, Analysis of Belt Tensions, Condition for Maximum Power, Selection of Flat & V-Belts, Adjustment of belt Tensions.

Text Books:

1. Design of Machine Elements V.B. Bhandari, TMH Publications.
2. Machine Design by Shigley – McGraw Hill Pub.

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3. Principles of Mechanical Design by R. Phelan – McGraw Hill Pub.
4. Machine Design By Spotts-PHI
5. Machine Design, by Norton.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPC42 Metrology, Measurement and Control

UNIT-I

Introduction to Measurement and Measuring Instruments, Generalized Measuring Systems and Functional Element, Static & Dynamic Performance Characteristic of Measurement Devices, Calibration, Concept of Error, Sources of Error, Analysis of Error.

Transducers: Types of Transducers and Their Characteristics, Measurement of Strain, Strain Gauges and Their Working, Gauge Factor, Strain Gauge Circuits, Strain Rosettes.

UNIT-II

Measurement of Pressure: Pressure Measuring Transducers, Elastic Diaphragms, Measurement of Vacuum and Low Pressure, Various Low Pressure Gauges.

Measurement of Fluid Flow: Various Methods of Flow Measurement and Devices
Temperature Measurement: Bi-Metallic Thermometers, Thermocouples, Thermistors and Pyrometers.

UNIT-III

Metrology: Standards of Linear Measurement, Line and End Standards System of Limit and Fits, Limit Gauges and Their Design, Measurement of Geometric Forms Like Straightness, Flatness, Roundness and Circularity, Measurement of Surface Textures, Quantitative Evaluation of Surface Roughness and Its Measurement, Introduction of CMM, Its Working and Application.

UNIT-IV

Interferometry: Principle and Uses of Interferometry, Types of Interferometers

Comparators: Classification, Working Principle and Magnification Range of Mechanical, Electrical, Optical, Electronic, Pneumatic Comparators, Measurement of Screw Threads & Gears, Two Wire and Three Wire Method

UNIT-V

Fundamentals of Control System: Control system concepts, classification of control systems, mathematical representation of system equations, hydraulic, pneumatic, thermal and mechanical system and their mathematical modelling, response characteristics of components and systems through classical solution.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

Text Books:

1. Beckwith and Buch, Mechanical Measurement
2. Jain RK Instrumentation
3. Raven H Automatic Control Engineering
4. Donal P Eckman Automatic Process Control
5. Nakra & Choudhary Instrumentation Measurement & Analysis
6. Nakra BC Theory & Application of Automatic Controls
7. Cooper Albert D Modern Electric Instrumentation PHI

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPC43 Welding Engineering

UNIT-I

Classification of welding: gas welding, Arc Welding and Equipments, types of welding Flames, Welding Techniques, Welding Torches and Blowholes. Submerged Arc Welding, TIG, MIG, Plasma Arc Welding and its Application.

UNIT-II

Arc Welding: Arc Welding Power Sources, Selection Factor for Power Sources, DC-Generator, rectifiers, Constant Current & Constant Voltage Machines, welding Transformers.

Welding Electrodes: Types, Electric Coating, Selection of Electrode, Classification, Coating of Mild Steel and Alloy Steel Electrode, Metal Transfer in Arc Welding.

UNIT-III

Resistance welding Process: Spot Welding, Seam, Projection, Butt Welding, Flash Butt Welding, Precision Welding.

Solid State Welding Process: Cold Welding, Diffusion Welding, Ultrasonic Welding, Explosive Welding, and Friction Welding.

Radiant Energy Welding Process: Electrical Beam Welding, Laser Beam Welding.

UNIT-IV

Brazing, Soldering and their Application: Weld ability of Metals: Introduction, Welding of Cast Iron, Stainless Steel, Aluminium, Copper and its Alloys, Hydrogen Induced Cracking.

Welding Distortion: Distortion and Residual Stresses, Types, Control of welding Distortion, Various discontinuities in welds, Trouble shooting.

UNIT-V

Design of Weldment: Weld Geometry, Eccentric Loading Designing Torsion and bending, Designing welding fixtures.

Testing, Inspection and Specification: Destructive and Non-destructive methods of testing Weldment, WPS, PQR, and ASME section IX Welding.

Robotics and Automation in Welding: Modes of Automation, Positioners, Welding Fixtures, and Arc Motion Devices, Under Water Welding.

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Text Books:

1. American Welding Society, Hand Book VII Edition Vol. II.
2. Nadkarni S.V., Modern Arc Welding..
3. Welding Engg. , Little, TMGH.
4. Khanna O.P., Welding Technology, Dhanpat Rai & Sons.
5. Parmar R.S., Welding Processes & Technology, Khanna Publishers.
6. Parmar R.S., Welding Engg. & Technology, Khanna Publishers.
7. P.N.Rao, Manufacturing Technology Vol-I, TMH

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPE41 - Materials Management

UNIT-I

Introduction: Definition and scope, concept of integrated materials management, materials research, materials planning and budgeting, codification, standardization.

Purchasing: Objective and function of purchasing department, purchasing procedure, negotiation, and source-selection.

UNIT-II

Types of purchasing, buying seasonal commodities, purchasing under uncertainty, purchasing of capital equipment, international purchasing, public buying, legal concept in buying, insurance buying, price forecasting.

UNIT-III

Stores management, stores system and procedure, incoming material control, stores accounting and stock verification, obsolete, surplus and scrap management.

UNIT-IV

Basic inventory system: concept of inventory, types of inventory, relevant costs of inventory, economic order quantity, inventory control techniques, basic models of inventory.

Spare parts management: definition of spares and its classification, MUSIC-3D, view of spares, multi echelon spares inventory.

UNIT-V

Value analysis: value importance, normal degree value analysis applied to purchase; organizing for value analysis, cost analysis and value analysis aid purchase research. Material and process selection in VE design, material, process & supplier decisions.

Text Books:

1. Materials Management an integrated approach, Gopalkrishnan.P & Sundaresan.M (2002) Prentice Hall India Limited, NewDelhi.

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2. Materials Management Text and Cases, Chitlae, A.K & Gupta, R.C. (2009) Prentice Hall India Limited. New Delhi.
3. Maintenance and Spare parts Management, Pathak () Prentice Hall India Limited, New Delhi.
4. Production and Operations Management, Chary, S.N. () Tata McGraw Hill.
5. Material management: An integrated approach, Dutta ()

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPE42 - Plant Layout & Material Handling

UNIT-I

Plant facility location –concept of plant facility, its scope, importance and objectives nature of location decision, need for facility location planning, general procedures and factors influencing location decision, facility location models, economics and cost analysis, rural and urban location pattern in India.

UNIT-II

Layout Designs –Industrial plant design consideration, types of production types of layout, factors affecting layout tools, techniques and procedure used in workstation and plant layout, quantitative technique in plant layout, developing product and process layout, comparing layouts, criteria for computerized facility layout, concept of computerized layout programs like CRAFT, CORELAP, ALDEP and PLANET.

UNIT-III

Flow pattern design -Overall system flow cycle, need and advantage of planned material flow, factors for consideration, designing flow pattern, flow patterns for production lines and assembly lines methods.

UNIT-IV

Material Handling- scope and functions of material handling, manual mechanical handling ratio, principles of material handling, analysis of material handling problem, classification of material handling system, salient features and application of general purpose material handling equipment, material handling in stores and warehouses, automation in part handling handling and industrial robots, optimum allocation of material handling equipment.

UNIT-V

Automated material handling system, concept of AGVs, AR/RS and Methods to minimize cost of material handling., safety in material handling , evaluation of material handling process, design procedure of cranes , lifts.

Text Books:

- 1 Practical plant layout by Muther
- 2 Plant layout and design by James More
- 3 Manufacturing Management- a Quantitative approach by Robert Aolsem.
- 4 Productions and Operation Management by Lockyer

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPE43 - Maintenance and Reliability Engineering

UNIT-I

Concept of reliability: objectives, applications, area of use, use of reliability in industry. The reliability functions, mean time between failures, hazard rate function, bath tub curve, conditional reliability, probability density function, failure rate, failure density, hazard rate, uncertainty measures.

UNIT-II

Constant and time dependant failure models: Exponential, weibull, normal and lognormal Distributions, discreat distribution, binomial distribution, poisson distribution.

Reliability of systems, Series, parallel, mixed connected systems, K-out of M system. Concept of redundancy, objectives, applications, redundant standby systems, system structure functions, minimal cuts and minimal paths, common mode failures, three state devices.

UNIT-III

Determination of reliability (state dependant systems): Markov analysis, load sharing system, standby systems, degraded systems.

Failure Analysis: Introduction to failure mode and effect analysis, FMEA and FMECA, criticality analysis, Fault tree diagram, event tree. **Availability:** concept and definitions, types of availability model, system availability.

UNIT-IV

Introduction: Objectives and policies of maintenance, maintainability terms and definitions, maintainability organization functions and tasks, estimation of maintainance cost.

Types of maintenance: breakdown, predictive, replacement, on-line, off-line, preventive Maintenance, reconditioning and correction maintenance, Preventive maintenances v/s. repair, reliability centered maintainace, condition based maintainance, principals and level of CBM.

UNIT-V

Total productive maintainace, goals objective benefits of TPM, component of TPM, calculation of OEE.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

Training for maintainace personal, objective and level of training, types of training methodology, evaluation of maintainance department.

Text Books:

1. Clifton R H, "*Principles of Planned Maintenance*", McGraw Hill, New York, 2001.
2. Ebling CE, "*An introduction to Reliability and Maintainability Engineering*" Tata McGraw Hill,
3. Srinath L S "*Reliability Engineering*", Affiliated East-West Press Limited, New Delhi, 2002.
4. Dhillon B S, "*Engineering Maintainability*", Prentice Hall of India, New Delhi, 2000.
5. Maintainace and spare parts management by P. Gopal krishnan PHI.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPE51 - Automobile Engineering

UNIT-I

Introduction of an automobile, component and basis structure of automobile, classification, difference between automobile and automotive, the chassis construction & classification, defect in frames, frameless construction & specifications. Wheel and tyres: Types of wheel, wheel dimension, desirable tyres properties, types of tyres, tyre material, tyre dimension, factor affecting tyre life.

UNIT-II

Transmission system: Function of transmission types, sliding mesh gear box, constant mesh gear box synchro mesh gear box, cylindrical gear box, torque converter, propeller shaft, universal joint, hooks joint, final drive, differential, performance of gear box.

UNIT-III

Clutches: Requirement, function & type of clutch, dry friction clutch, wet friction clutch, clutch plate, single plate & multiple plate clutch, centrifugal clutch, and fluid fly wheel. Suspension system function and requirement, leaf spring, torsion bar, telescopic shock absorber.

UNIT-IV

Brakes: Function and requirement, brake efficiency, wheel skidding, types of brake, electrical, mechanical and hydraulic & pneumatic brakes, master cylinder, wheel cylinder, self-actuating brakes, brake drum, brake liners, brake shoe, trouble shooting.

UNIT-V

Front axle and suspension wheel alignment purpose, factor of front wheel alignment, steering geometry, correct steering angle, steering mechanism, under steer and over steer, steering gear, power steering, reversibility of steering gears, steering gear ratio, calculation of turning radius.

Engine emission: Emission standard of vehicle in India, Euro norms, emission, testing. Principle of multipoint fuel injection (MPFI), component of MPFI, Different sensors of MPFI system; vehicle air conditioning, Catalytic connectors, engine troubles & repairs.

Text Books:

1. Automobile Engineering Kripal Singh Vol. I, II
2. Automobile Mechanics Joseph Heitner.
3. Automobile Engineering Giri N.K
4. Automobile Engineering by Shrinivasan T.M.H.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPE52 - Power Plant Engineering

UNIT-I

Introduction:

Sources of energy, present power position in India, non-conventional energy and their application, steam power plant. High-pressure boilers and their classification and working. Boiler accessories and mountings, condenser and their types.

UNIT-II

Solar Energy: Solar Insulation Calculation, Flat plates and concentrating collectors for liquid and gases, construction.

Collector Area Calculation: heat removal Factor, Efficiency.

Solar System: Power plants, low temperature and high temperature plants, solar dryers, solar cookers, solar refrigeration systems, solar panel.

UNIT-III

Nuclear Energy: Introduction to Nuclear Engineering, Release of Energy by Nuclear Reaction, chain reaction, moderation, components of nuclear reactor, types of reactor, Pressured water reactor, CANDU reactor, Gas cooled reactor, Liquid metal cooled reactor, breeder reactor, Nuclear Materials.

UNIT-IV

Geothermal power plant. Wind energy: Type of Rotors, horizontal axis and vertical axis systems, system design and site selection blade material. Wind power scenario in India. Bio Gas Plant: Types, parameters affecting plant performance, plant design.

UNIT-V

Direct Energy Conversions: fuel Cells, Thermo-electric, Thermo ionic and MHD Systems (Magneto Hydrodynamic system), Economic analysis of Power plant tariffs.

Text Books:

1. Power plant Engineering, Domkundwar & Arora, Dhanpat Rai Publication.
2. Sukhatme, S.P., Solar energy, TMH Publication.
3. Duffie and Beckman, Solar Energy Thermal Processes, John Wiley.
4. P.K.Nag, Power plant Engineering.
5. Power Plant Engineering by Wakil, TMH

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TPE53 - Heat and Mass Transfer

UNIT-I

Introduction

Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, combined modes of heat transfer, thermal transfer, thermal diffusivity, overall heat transfer coefficient.

Conduction

The thermal conductivity of solids, liquids and gases, factors in influencing conductivity measurement. The general differential equation of conduction, one dimensional steady state conduction, linear heat flow through a plane and composite wall, tube and sphere critical thickness of insulation, effect of variable thermal conductivity, conduction with heat generation in flat and cylinders.

UNIT-II

Fins

Conduction convection system, extended surfaces rectangular, triangular circumferential and pin fins. general conduction analysis, fins of uniform and non-uniform cross section area. Heat dissipated by a fin. Effectiveness and efficiency of fin. Approximate solution. Design a fin for maximum heat transfer. Solution for different boundary condition. Use of fins analysis for measuring temperature error of thermometer.

Transient/ unsteady state heat conduction

Introduction to unsteady state heating and cooling, system with negligible internal resistance, lumped capacity method and its validity. Unsteady state conduction through finite and semi-infinite slab without surface resistance, convection boundary conditions. Solution through Heisler's chart.

UNIT-III

Forced Convection: Physical mechanics of forced convection. Dimensional analysis for forced convection, velocity and thermal boundary layer, flow over plates, flow across cylinders and spheres, flow in tubes, Reynolds's analogy.

Natural Convection Physical mechanism of natural convection, Dimensional analysis of natural convection, empirical relationship for natural convection.

UNIT-IV

Boiling and Condensation: Boiling heat transfer, pool boiling, boiling regimes and boiling curve, heat transfer, correlations in pool boiling. Condensation heat transfer, film condensation, derivation for the average heat transfer coefficient 'h' for the case of laminar film condensation over vertical.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

Heat Exchangers: Different type of heat exchanger. Determination of heat exchanger performance, heat exchanger transfer unit, analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method).

UNIT-V

Thermal Radiation

Introduction, absorption and reflection of radiant energy, emission, radiosity and irradiation, black and non black bodies, Kirchoff's law; intensity of radiation, radiation exchange between black surface, geometric configuration factors. Grey body relation exchange between surface of unit configuration factors.

Introduction to mass Transfer

Mass and mole concentrations, molecular diffusion, eddy diffusion, molecular diffusion from an evaporating fluid surface, introduction to mass transfer in laminar and turbulent convection combined heat and mass transfer.

Text Books:

1. Heat transfer-S.P. Sukhatme-TMH
2. Heat & Mass Transfer-Arora and Domkundwar-Dhanpat Rai
3. Heat Transfer-C P Arora, TMH
4. Heat & Mass Transfer-R.C. Sachdeva-New Age
5. Heat Transfer-J.P. Holman-TMH
6. Heat Transfer-A Practical Approach- Yunus A. Cengel

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TOE21 - Enterprise Resource Planning

UNIT-I

Introduction to Enterprise resource planning, Evolution of ERP, MRP, MRP-II, e-ERP, Generic business model with reference to ERP, Structure of ERP Two tier architecture client, server, Three tier architecture, repository, RDBMS, Operating systems, Generic model of ERP system - Design tree node structure, Design of, Role/Activity Diagrams, Benchmarking, Types of Benchmarking, Process of Benchmarking.

UNIT-II

Introduction to Business Process Re-engineering, Procedure of BPR, Principle of BPR, Process improvement Process redesign

UNIT-III

Introduction : Supply chain Management and ERP, understanding the supply chain with case examples, Supply chain performance with measures, Achieving strategic fit and scope, Supply chain drivers, Supply chain obstacles, ERP Vs SCM, Benefits of supply chain improvement, Introduction of Logistics Types of Logistics, Types of Logistics, Benefits of Logistics.

UNIT-IV

Integrated SAP model, Integrated Data, Master Data, Transactional Data, Integrated processes, Evolution Electronic Data Interchange (EDI), Use of EDI, and Benefits of EDI, Selection of ERP: Introduction Opportunities and problems in ERP selection, Approach to ERP selection of ERP.

UNIT-V

Origins of SAP, SAP's Markets, SAP architecture and integration, SAP Business structure, Customization of SAP, SAP R/3 material Management, Sales and Distribution, Production, Plant Maintenance, Quality Management, Methodology for ERP implementation, Implementation phases, Implementation of Life cycle

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

Text Books:

1. Enterprise Resource Planning: Theory and practice by Rahul V, PHI Publication.
2. Enterprise Resource Planning: Concepts and practice by V.K. Garg, TMH Publication.
3. Enterprise Resource Planning by Alexis Leon, McGraw-Hill Publication

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TOE22 - Management Information System

UNIT-I

Organisation & Types, Decision Making, Cost & value of information, Introduction to information in business, types of information system, need, importance, scope and characteristics of information system. Component of information system, developing information system.

MIS concept evaluation and characteristics structure of MIS, MIS v/s data processing, MIS and DSS

UNIT-II

Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS- dataflow diagram, flow chart etc.

Data base technology- introduction, data base and enterprise management, data independence data base approaches, data base architecture, data models, DBMS SQL and working, 4GL, data administration.

UNIT-III

Business application of information technology: electronic commerce Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage.

UNIT-IV

Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TOE22 - Management Information System

UNIT-I

Organisation & Types, Decision Making, Cost & value of information, Introduction to information in business, types of information system, need, importance, scope and characteristics of information system. Component of information system, developing information system.

MIS concept evaluation and characteristics structure of MIS, MIS v/s data processing, MIS and DSS

UNIT-II

Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS- dataflow diagram, flow chart etc.

Data base technology- introduction, data base and enterprise management, data independence data base approaches, data base architecture, data models, DBMS SQL and working, 4GL, data administration.

UNIT-III

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UNIT-IV

Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools.

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

UNIT-V

Advanced concepts in information system: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production & Logistics, Supply Chain Management, CRM, Procurement, Management System Object Oriented modeling case studies.

Text Books:

1. O.Brian, "Introduction to Information System", McGraw Hill.
2. O.Brian, "Management Information System", TMH.
3. MIS by Rahul De Wiley.
4. MIS Louden and lauden PHI
5. Bansal, "Information System Analysis & Design", TMH.
6. Jawadegar, "Management Information System", TMH.
7. Murdick, "Information System for Modern Management", PHI.
8. Alexis Leon, "Enterprise Resource Planning", TMH.
- 9 MIS by Sadagopan, PHI

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

IP6TOE23 Six Sigma and DOE

UNIT-I

Quality Perception : Quality in Manufacturing, Quality in Service Sector, Differences between Conventional and Six Sigma concept of quality,

Probability Distribution: Normal, Binomial, Poisson distribution.

Basics of Six Sigma: Concept of Six Sigma, Defects, DPMO, DPU, Attackson X'S, Customer focus, Six Sigma for manufacturing, Six Sigma for service, Z score, Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

UNIT-II

Methodology of Six Sigma: DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects. , Introduction to software for Six Sigma, Understanding Minitab, and Graphical analysis of Minitab plots.

UNIT-III

Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis.

UNIT-IV

Design of Experiments: Applications of experimental Design, basic principles, design guidelines, statistical design and problems. Experimental design; statistical analysis of data. Loss function and its calculations.

UNIT-V

Comparative Experiments: Statistical concepts, sampling and sampling Distributions, Inferences about the differences in means, randomized design, and inference about differences in means paired comparison design, inferences about the variances of normal distributions, problems. Experiment with single factor: the analysis of variance (ANOVA), analysis of fixed effects models, model adequacy checking, practical interpretation of results, sample computer output, determining the sample size, discovering the dispersion effect, the regression approach to the ANOVA, and non-parametric method in the ANOVA.

Text Book:

1. Issa Bass, Barbara Lawton, Lean Six Sigma Using Sigma XL and Minitab,

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING B.TECH VI SEMSTER

- 1/e, Tata McGraw-Hill, 2010.
2. DOE by Phillip Ross PHI.
3. P. Pande and L. Holpp, What is Six Sigma, 1/e, Tata McGraw-Hill, 2002.
4. P. Pande, The Six Sigma Way, 1/e, Tata McGraw-Hill, 2003.
5. R. Cavanagh, R. Neuman, P. Pande, What is Design for Six Sigma, 1/e, Tata McGraw- Hill, 2005.
6. SIX SIGMA by KK BHOTE Mc-graw hill.
7. D.C. Montgomery, Design and Analysis of Experiments, 8th Edition, John Wiley.

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INSTITUTE OF TECHNOLOGY (SCHOOL OF ENGINEERING & TECHNOLOGY)
GURU GHASIDAS VISHWAVIDHALAYA
(A CENTRAL UNIVERSITY ESTABLISHED BY THE CENTRAL UNIVERSITY ORDINANCE 2009, NO: 3
OF 2009)

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
C.B.C.S. STUDY & EVALUATION SCHEME

W.E.F. SESSION 2018-2019

Year: B. Tech. IV year

SEMESTER-VII

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP7TPC51	Principles of Management	4	0	0	40	60	100	4
2.	IP7TPC52	Production Planning and Control	3	1	0	40	60	100	4
3.	IP7TPC53	CAD /CAM	3	1	0	40	60	100	4
4.	IP7TOE3..	Elective-OE3	3	0	0	40	60	100	3
5.	IP7TPE6..	Elective-PE6	3	0	0	40	60	100	3
Total			16	2	0	200	300	500	18
PRACTICALS									
6.	IP7LPC53	CAD/CAM lab	-	-	3	30	20	50	2
7.	IP7LPC54	Seminar on Summer Training (About 30 Days)**	-	-	3	50	-	50	2
8.	IP7LPC55	Minor Project	-	-	4	50	-	50	2
Total			-	-	10	130	20	150	6
Grand Total			16	2	10	330	320	650	24

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Industrial & Production Engg
Institute of Technology
G.G.V.V. Koni, Bilaspur (C. G.)



Elective- Open Elective (OE)-3		Elective- Professional Elective (PE)-6	
S.N.	IP7-TOE3..	S.N.	IP7-TPE6..
31	Product Design & Development	61	Machine Tool Design
32	Entrepreneurship Development	62	Refrigeration And Air Conditioning
33	Strategic Management	63	Composites Materials & Technology

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VII Sem.	IP7-TPC51	Principal of Management	4	-	-	4	Max Marks-60 Min Marks- Duration-3Hrs

PRINCIPLES OF MANAGEMENT

UNIT-I

Definition of management, science or art, manager vs entrepreneur; Types of managers managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

UNIT-II

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes.

UNIT-III

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

UNIT-IV

Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT-V

Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

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Text Books

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.
2. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004.
3. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999.
4. Essential of management, Koontz & O'Donnel, McGraw-Hill.
5. Organizational Behavior, Stephen P. Robbins, PHI.
6. Organization and Management, Agrawal R.D, TMH.Principles of Management, Terry & Francklin, Richard – Frwin

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VII Sem.	IP7-TPC52	Production Planning And Control	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

PRODUCTION PLANNING AND CONTROL

UNIT - I

Introduction: Introduction to various Types of Production System viz. Mass Production, Job Shop, Batch Production System, Continuous Production System, Concept of Production and Operation Management, Objective & functions of PPC.

Forecasting: Time Series method, moving average, weighted average, Trend, Seasonality, Regression Technique, Delphi Method.

UNIT - II

Aggregate Planning: Definition, Strategies, Pure and mixed strategies, methods.

Master Production Schedule: objective and functions, Design of MPS, Bill of Materials.

Material Requirement Planning: objectives, functions, MRP, MRP-II, limitations.

Capacity Requirement Planning: Definition, Objectives, Process of CRP, Process Sheet, Rough Cut Capacity Planning, Loading, and Preparation of CRP chart.

UNIT - III

Scheduling: Types, Single Machine Scheduling, Job shop Scheduling, Flow Scheduling;

Sequencing: various priority rules; Line of Balancing: Rank and positional weight method, Kilbridge westner method.

Facility location and facility location problems: Factors affecting plant locations, single facility locations problems and its methods.

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UNIT - IV

Types of layout- layouts design procedure such as CORELAP, CRAFT etc., Material handling system & their classification, principles. JIT & KANBAN. Depreciation & methods of depreciation.

UNIT-V

Maintenance Management: Types of maintenance strategies, Breakdown and Preventive Maintenance, Predictive and Total Productive Maintenance, Condition monitoring, Individual and group replacement policies. Make or Buy Decision, concept of original equipment effectiveness.

Text Books

1. Production and operation management, O.Paneerselvem, TMH.
2. Production and operation management, Adem Ebert
3. Production and operation management, Charry S.N. TMH
4. Production and operations management Theory and practice Mahadevan.B
5. Production and operation management, Joseph .G. Monks, TMH
6. Handbook of Material Handling, Ellis Horwood limited
7. Operations Management: Design Planning and control for the manufacturing and services
Lawrence.P.Atkin, James B. Dilworth Tata Mc Graw Hill
8. Production and Operations management, R.B Khanna, PHI.
9. Production operations management S.N.Buffa, PHI.

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VII Sem.	IP7-TPC53	Computer Aided Design And Manufacturing (CAD/CAM)	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

COMPUTER AIDED DESIGN AND MANUFACTURING (CAD/CAM)

UNIT-I

Basics of CAD: Basics fundamental of Computer Graphics, Principle of computer graphics, Product life cycle, Concept of Computer Aided Design (CAD) and architecture, Hardware and software, Color management, Raster graphics, Graphic primitives, lines, and Circle Drawing algorithms, Software documentations, CAD standards GKS, OpenGL, Data exchange standards- IGES, STEP, CALS etc, Communication standards, Standards for vexchange images.

UNIT- II

Geometric Modeling of Curves, Surface and Solid: Basics representation of curves, Parametric and non-parametric curves, Mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves.

Basic of Surface, Techniques of surface modelling, Plane surface, Rule surface, Surface of revolution and sweep, Coons and bi-cubic patches, concept of Bezier and B-spline surfaces, Basic concept of solid modelling technique, CSG and B-rep method for solid generation.

UNIT - III

Geometric Transformation: Computer Aided Design (CAD) methodology, Coordinate systems, Theory and applications, 2D and 3D geometric transformation, Homogeneous transformation, Concatenation, Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, Visual realism- hidden line-surface-solid removal algorithms, shading, colouring, computer animation, Concurrent Engineering.

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UNIT - IV

Basics of CAM: Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, Application of NC, concepts of computer numeric control(CNC) system, problems with conventional, NC, CNC.

Part Programming: Introduction to NC part programming, manual part programming, Computer assisted part programming, Automatically Programming Tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

UNIT- V

Advance Manufacturing System: Concept of distributed numeric control (DNC) system, and its advantages and disadvantages of over NC and CNC, Concept of computer integrated method (CIM), Flexible manufacturing system(FMS), benefits and applications of CIM and FMS, Group Technology(GT), parts classification and coding systems, benefits and applications of GT, automated storage and retrieval system (AS/RS), Automated guided vehicle(AGV).

Text Books

1. Principles of Computer Graphics, W. M. Neumann and R.F. Sproul, McGraw Hill
2. Computer Graphics, D. Hearn and M.P. Baker, Prentice Hall Inc
3. Production System & Automation, Groover, Prentice Hall, India
4. CAD/CAD Theory & Practice-I.Zeid & R. Sivasubramaniam, TMH
5. CAD/CAM. Groover & Zimmer, Prentice Hall, India
6. Computer Graphics & CAD, Ramamurthy, T.M.H.
7. Industrial Robotics & CIM, Surendra Kumar I.B.H.
8. CAD/CAM, P.N.Rao, Prentice Hall, India.
9. CAM T.C. Chang & Wang, Pearson.
10. Mastering CAD CAM, Ibrahim Zeid, Tata McGraw Hill Publishing Co.
11. CAD/CAM Principles, C. McMohan and J. Browne, Pearson Education

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VII Sem.	IP7-TOE..31	Product Design & Development	4	-	-	4	Max Marks-60 Min Marks- Duration-3Hrs

PRODUCT DESIGN & DEVELOPMENT

UNIT-I

Product Design : Definition, Design by evolution, Innovation, essential factors of product design, production-consumption cycle, flow and value addition in the production – consumption cycle, the morphology of design, primary design phases and flow charting, role of allowance, concurrent engineering.

UNIT-II

Product Design practice and Industry : Introduction, product strategies, time to market, analysis of the product, three S's, standardization, renard series, simplification.

Designer: Role, Myth and reality. Industrial design organization, basic design considerations.

Industrial Designer: Problems, procedure for adoption, types of models. Role of aesthetics in product design, functional design practice.

UNIT-III

New products Idea generation: modification. Product variants: adding, dropping. Formal testing: new products, concept, product testing, market tests, evaluation, adoption, expansion and forecasting.

Economic factors influencing design: Product value, economic analysis, profit and competitiveness.

Product design for environment: Introduction, importance of DfE, environmental factors, scope of environmental impact, design guidelines for DfE.

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UNIT - IV

Developing product strategy: Benefits of strategy, elements of a product strategy, setting objectives, selection of strategic alternatives, increasing sales/market share, increasing profitability. Design for manufacturing and Design for assembly, Ergonomics in design, Modular versus integral design.

Human Engineering Considerations in product design: Introduction, Anthropometry, Design of controls, The Design of displays, Man/Machine Information exchange.

UNIT -V

Intellectual property systems: Definition, Concept of Intellectual Property, Kinds of Intellectual Property, Economic importance of Intellectual Property. Importance of IPR, TRIPS and its implications.

Trademark: Introduction, historical development of the concept, Need for Protection, Kinds of Trademarks, and Well known Trademarks. Patents: Historical development, Concepts, Novelty, Utility, Inventiveness/Non-obviousness. Copyrights, Industrial design.

Text Books

1. Chitale A. K. and Gupta R. C.; Product Design and Manufacturing, PHI.
2. Gupta V., Lal G.K. and Reddy; Fundamentals of Design and manufacturing; Narosa Publishing.
3. James Garratt, Design and technology (1996) Published by Cambridge University Press
4. Donald R .Lehman, Rusell S. Wines 3rd Edition, Product Management TMH.
5. Product Life Cycle Engineering and Management, CEP Lecture notes, Prof B Ravi, IIT Bombay
6. Karl. T. Ulrich and Steven D. Eppinger "Product Design & Development" – TMH – 3rd addition.

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VII Sem.	IP7TOE...32	Entrepreneurship Development	4	-	-	4	Max Marks-60 Min Marks- Duration-3Hrs

ENTREPRENEURSHIP DEVELOPMENT

UNIT- I

Entrepreneurship Concepts: Concepts of entrepreneurship, Characteristics of successful entrepreneurs, Functions of entrepreneurs, Types of entrepreneurs, Distinction between entrepreneur and manager, Growth of entrepreneurship in India and role of entrepreneurship in economic development

Types of entrepreneurship: Women entrepreneurship, Rural entrepreneurship, Tourism entrepreneurship, Agripreneurship, social entrepreneurship & family business – Factors affecting entrepreneurship growth.

UNIT- II

Entrepreneurship Development: Entrepreneurship development programmes Objectives, contents and evaluation. Small Enterprises: Micro and macro units, scope of micro and small enterprises and their role in economic development – problems of micro and small enterprises – promotional packages.

Types of Business Organization: Sole proprietorship, partnership joint stock company, cooperative organization, public sector organization.

UNIT- III

Opportunity / Product Identification: Business opportunities in various sectors, identification of business. Opportunity- idea generation and opportunity selection. Steps in setting up of small business enterprises. Formulation of business plans and project appraisal. Contents of business plans, significance and formulation.

Guide lines for formulating project reports: Methods of project appraisal –economic, financial, market analysis, technical feasibility and managerial competency environmental clearance.

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UNIT- IV

Financing of Enterprise Source of finance: internal and external sources, capitalization, term loans- short term finance, venture capital, export finance. Institutional finance- commercial banks, other financial institution, institutional support.

Support Institutions: National small industries, corporation ltd, small industries development organization, small scale industry board, state small industry development organization, small industries service institutes, direct industry centre, technical consultancy organizations

Government policy and taxation: Benefits to small scale industry, tax benefits, incentives and concession for small scale industries. Government policies for small scale enterprises and industrial policy resolutions.

UNIT- V

Start-up Business: Why start a business, key consideration, start-up a process, presentation to investors, company considerations, equity considerations, key factors for success.

Government strategies: Growth of enterprises, Objectives of growth, stages and types of growth- Expansion diversification, joint venture, mergers and acquisitions, sub-contracting and financing.

Sickness in small industries: Meaning of industrial sickness, signals and symptoms of industrial sickness, causes and consequences, corrective measures to curb sickness, government policies on revival of sick units.

E-commerce: Basic concepts, advantages and disadvantages.

Text Books

1. Entrepreneurship, Roy, Rajiv, Univ. Press.
2. Entrepreneurship, Hisrich, McGraw Hill
3. Entrepreneurship Development, Kumar, New- Age.
4. Entrepreneurship Development, Kaulgud, Thomson Learning.
5. Entrepreneurship: Theory & Practices, Saini, Wheeler.
6. Entrepreneurship Development, Dr. S.S. Khanka S. Chand.

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UNIT-IV

Strategy Implementation & Evaluation - The implementation process, Resource allocation, designing organizational structure-Designing Strategic Control Systems, Matching structure and control to strategy-Implementing Strategic change-Politics-Power and Conflict, Techniques of strategic evaluation & control-case study.

UNIT-V

Other Strategic Issues - Managing Technology and Innovation, Strategic issues for Non Profit organizations, New Business Models and strategies for Internet Economy-case study

Text Books

1. Thomas L. Wheelen, J.David Hunger and Krish Rangarajan, Strategic Management and Business policy, Pearson Education., 11th edition, 2007.
2. Charles W.L.Hill & Gareth R.Jones, Strategic Management Theory, An Integrated approach, Biztantra, Wiley India, 6th edition, 2007.
3. Azhar Kazmi, Strategic Management & Business Policy, Tata McGraw Hill, Third Edition,

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VII Sem.	IP7- TPE...61	Machine Tool Design	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

MACHINE TOOL DESIGN

UNIT - I

Introduction to machine tool design and mechanism: definitions, classification and general; requirement of machine tool, working and auxiliary motions in machine tools, parameters defining working motion of a machine tools, layout of machine tools.

Regulation of speed and feed rates: objective of speed and feed rate regulation, design of speed box, general recommendation for developing the gearing diagram, determining the number of teeth of gear boxes, mechanical step less regulation of speed and feed rates.

UNIT- II

Design of machine tool structures: function of machine tool structures and their requirement, design criteria for machine tool structures, material of machine tool structures, static and dynamic stiffness, profile of machine tool structures, basic design procedure of machine tool structures, design of bed.

UNIT - III

Design of guide ways and power screws: function and types of guide ways, design of slide ways, design criteria and calculation for slide ways, guide ways operating under liquid friction conditions. Design of aerostatic slide ways, design of anti-friction guide ways, design of power screws.

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UNIT - IV

Design of spindles and spindle supports: function of spindle unit and requirements, material of spindles, effects of machine tool compliance on machining accuracy, design calculation of spindles, design of jigs and fixtures: principle of jigs and fixtures design, locating and clamping, jig bushes, drilling jigs.

UNIT - V

Press work die design: Classification of presses and dies, cutting action in dies, clearances and cutting forces, shear, center of pressure, method of mounting punches, design of blanking dies, drawing die design.

Text Books

1. Machine Tool Design by NK Mehta Tata Mcgraw Publication.
2. Basu, S.K., Design of Machine tool, Allied Publishers, New Delhi.
3. Koenigsberger, F., Design Principles of Metal cutting machine Tools, pergamon Press, Oxford, 1964.
4. Push, V.E., Design of Machine Tools, Mashinostroenie Publishers, Moscow, 1977.
5. Machine Tool Design, vols. I-IV, Mir Publishers, Moscow, 1968.

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VII Sem.	IP7-TPE...62	Refrigeration & Air Conditioning	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

REFRIGERATION & AIR CONDITIONING

UNIT - I

Carnot Refrigerator & Heat pump: air refrigeration systems, bell Coleman air refrigeration cycle. Air craft system & its performance.

Vapour compression refrigeration: simple cycle, t-s and p-h charts analysis of vapor compression cycle, factors effecting performance of vapor compression cycle, actual vapour compression cycle, multi stage compression system.

UNIT - II

Vapour absorption refrigeration systems: description of system components, aqua ammonia and water lithium bromide systems. Its analysis & advantages over vapour compression system.

Refrigeration equipment: constructional details, capacity, control and performance of compressors, condensers, evaporators, expansion devices, thermostatic expansion valve.

UNIT - III

Production of low temperature - cascade system, Joule Thomson effect & liquefaction of gases, liquefaction of hydrogen & helium, application of cryogenics.

Nonconventional refrigeration system-thermo-electric refrigeration, vortex tube, steam jet refrigeration system.

Refrigerants: classification, properties & selection of refrigerants.

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UNIT - IV

Psychometrics: Psychrometry and psychometric properties, psychometric relations, psychometric chart and its use, psychometrics processes, human comfort, factors affecting comfort, comfort chart.

Requirements of comfort air conditioning: thermodynamics of human body, comfort chart, factors governing optimum effective temperature.

Cooling load calculations & design of a.c. system- different heat sources, design of air conditioning system, bypass factors, effective sensible heat factor, cooling coils.

UNIT - V

Fluid flow, duct design & air distribution system- various losses in fluid flow, different methods of duct design & arrangement system, air distribution system & ventilation system.

Automotive air conditioning: system location and layout, components, system maintenance. Car, Railway air conditioning & marine air conditioning.

Text Books

1. Refrigeration and Air Conditioning C. P. Arora - TMH.
2. Refrigeration and Air Conditioning – Manohar Prasad – New-Age International Pub
3. Refrigeration and Air Conditioning – Arora & Domkundwar – Dhanpat Rai & Sons
4. Refrigeration and Air Conditioning – P.L. Ballaney – Khanna Pub.

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VII Sem.	IP8PET...63	Composite Materials and Technology	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

COMPOSITE MATERIALS AND TECHNOLOGY

UNIT - I

Introduction to Composites Definitions. Typical reinforcements and matrices. Typical properties of fibre composites; mechanical, weight, chemical resistance, etc., compared with "standard" materials. Particular composites. Quality assurance, outline of manufacturing methods. Economic aspects. Dependence of properties on manufacturing route; typical manufacturing defects. Applications. Fibre strengthening; fibre flaws, critical length, critical volume fraction. Natural composites (wood, bone, etc.)

UNIT - II

Fibres Manufacturing methods: Physical and chemical characteristics. Mechanical and other properties of commonly used fibres - carbon, glass, aramid and other organics, ceramics. Fibre coating to achieve compatibility with matrix. Use of statistical methods to characterize fibre behaviour. Naturally-occurring (cellulose) fibres. Whisker, typical properties, Manufacturing methods.

UNIT - III

Manufacture of Polymer Matrix Composites Principles of manufacturing processes (open and closed mould), including: hand and spray lay-up, press moulding, injection moulding, resin injection, RRIM, filament winding, pultrusion, centrifugal casting, autoclave, prepreg and other "starting" materials, etc. Machine methods for manufacture of composites. Cutting, drilling and other finishing operations.

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UNIT - IV

Engineering properties Stiffness and Strength: Geometrical aspects, volume and weight fraction. Unidirectional continuous fibre systems; stiffness and strength. Discontinuous fibres. Short fibre systems; length and orientation distributions. Woven reinforcements. Hybrids. Failure theories for unidirectional lamina. Micro mechanics theories.

UNIT - V

Mechanical Testing Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear. Typical standard methods. Use of photo elastic, holographic and other methods of strain measurement.

Metal Matrix Systems Metals and alloys; solidification processes, diffusion bonding, mechanical properties. Boron fibre reinforced aluminium and titanium alloys. Alumina fibre reinforced aluminium alloys. Silicon carbide fibre reinforced aluminium alloy. Particulate systems.

Text Books

1. Introduction to Composite Materials Design: Ever J Barbero Taylor and Francis.
2. Mechanics of Composite Materials: Robert Jones Second Edition 1999 Taylor and Francis.
3. Composites and Processing Methods: Ed. Venkatesan Narosa Publications.

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INSTITUTE OF TECHNOLOGY (SCHOOL OF ENGINEERING & TECHNOLOGY)
GURU GHASIDAS VISHWAVIDHALAYA
(A CENTRAL UNIVERSITY ESTABLISHED BY THE CENTRAL UNIVERSITY ORDINANCE 2009, NO: 3
OF 2009)

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
STUDY & EVALUATION SCHEME

W.E.F. SESSION 2018-2019

Year: B.Tech. IV year

SEMESTER-VIII

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP8TPC61	Operation Research	3	1	0	40	60	100	4
2	IP8TPC62	Marketing Management	4	0	0	40	60	100	4
3	IP8TPE7...	Elective-PE7	4	0	0	40	60	100	4
4	IP8TOE4...	Elective-OE4	4	0	0	40	60	100	4
Total			15	1	0	160	240	400	16
PRACTICALS									
6.	IP8LPS02	Project	-	-	12	120	80	200	6
7.	IP8LPC01	Comprehensive Viva	-	-	-	-	50	50	2
Total			-	-	12	120	130	250	8
Grand Total			15	1	12	280	370	650	24

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Elective- Open Elective (OE)-4		Elective- Professional Elective (PE)-7	
S.N.	IP8-OET...	S.N.	IP8-PET...
41	Supply Chain Management	71	Fluid Power Control
42	Safety Management And Labour Law.	72	Robotics and Robot Applications
43	Finite Element Method	73	Powder Metallurgy & Ceramics.

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VIII Sem	IP8-TPC61	Operation Research	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

OPERATION RESEARCH

UNIT -I

Introduction to linear programming, graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, maximization & minimization function with or without constraints, slack surplus & artificial, variable method, degeneracy problem

UNIT- II

Mathematical statement of the transportation problem, the transportation model, method for basic feasible solution, Degeneracy & unbalance problem, Mathematical statement of the assignment problem, solution of assignment problem, traveling sales-man problem.

UNIT-III

Game theory: rule of game, Method of solving game, graphically & Arithmetic, saddle point & without saddle point, dominance method, mixed strategies 2 X 2 game, 2 X N game, M X 2 game, 3 X 3 game (Method of matrix's, method of linear programming etc).

Inventory: Introduction, classification, function, level, control techniques, models, various costs associated, EOQ, optimum lot sizing.

UNIT-IV

Introduction of queuing theory, elements of queuing system, operating characteristics of a queuing system, Poisson arrivals & exponential service time, waiting time & idle time cost, single channel queuing theory.

Replacement problems, requirement policy, replacement of items, machinery various themes, group replacement policy, MAPI methods

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UNIT- V

Network analysis, Introduction of PERT & CPM, computation of PERT, Time estimation, measure of deviation & variation, probability of completing project, Arrow diagram & critical path method, Scheduling, cost analysis & crashing of network.

Text Books

1. Sharma & S D Kedarnath - Operation Research, Ramnath & Co Meerut
2. Operation Research, Sasien Yaspan
3. Operation Research – N. D. Vohra – TMH Publication
4. Operation Research–Hira & Gupta – S. Chand & Co.
5. Operation Research – H. Gillette – TMH, New Delhi
6. Operations Research – M. Taha – TMH, New Delhi
7. Operations Research – Phillip Ravindran- Wiley Publications

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VIII Sem	IP8-TPC62	Marketing Management	4	-	-	4	Max Marks-60 Min Marks- Duration-3Hrs

MARKETING MANAGEMENT

UNIT- I

Introduction to marketing management: what is marketing? The core concept, need, wants, demands, product, value cost its functions.

Marketing management: Production concept, product concept, and selling, marketing concept, role of marketing in modern organization, marketing philosophies.

UNIT- II

The nature of high performance business: corporate and division strategic planning, business strategic planning, marketing process. Analyzing consumer markets & buying behavior.

UNIT- III

The product life cycle: conditions and strategies in different phases. Marketing strategies through PLC.

New Product Decisions: Definitions and factors contributing to new production development, new product development process.

UNIT-IV

Deciding on the marketing Program: Product, promotion, pricing, place (Distribution Channel), Managing Advertising, Sales promotion, & public relation, developing & managing development program, sales promotion, public relation.

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UNIT-V

Managing retailing whole selling and logistic- types of retailers and levels of services, trends in retailing, types of whole selling, market logistics.

The role of marketing communication: communication process model and developing effective e communication, characteristics of marketing communication mix, factors in setting the communication mix.

Text Books

1. Product Design and Manufacturing, Chitale & Gupta, PHI.
2. Marketing Management, Philip Kotler PHI Publication

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VIII Sem	IP8-OET...41	Supply Chain Management	4	-	-	4	Max Marks-60 Min Marks- Duration-3Hrs

SUPPLY CHAIN MANAGEMENT

UNIT- I

Building a Strategic Framework to Analyze Supply Chains: What Is a Supply Chain? The Objective of a Supply Chain ,The Importance of Supply Chain Decisions, Decision Phases in a Supply Chain , Process View of a Supply Chain, Examples of Supply Chains ,Supply Chain Performance: Achieving Strategic Fit and Scope, Competitive and Supply Chain Strategies ,Achieving Strategic Fit ,Expanding Strategic Scope, Supply Chain Drivers and Metrics, Drivers of Supply Chain Performance, framework for Structuring Drivers, Facilities ,Inventory ,Transportation ,Information ,Sourcing ,Pricing.

UNIT- II

Designing the Supply Chain Network: Designing Distribution Networks and Applications to e-Business the Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network, e-Business and the Distribution Network, Distribution Networks in Practice.

Network Design in the Supply Chain: The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation, The role of IT in Network Design, Making Network Design Decisions in Practice.

Network Design in an Uncertain Environment: The Impact of Uncertainty on Network Design, Discounted Cash Flow Analysis ,Representations of Uncertainty ,Evaluating Network Design Decisions Using Decision Trees ,AM Tires: Evaluation of Supply, Chain Design Decisions Under Uncertainty ,Risk Management and Network Design 175,Making Supply Chain Decisions Under Uncertainty in Practice

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UNIT- III

Planning Demand and Supply in a Supply Chain: Demand Forecasting in a Supply Chain, The Role of Forecasting in a Supply Chain, Characteristics of Forecasts, Components of a Forecast and Forecasting Methods, Basic Approach to Demand Forecasting, Time-Series Forecasting Methods, Measures of Forecast Error, Forecasting Demand at Tahoe Salt, The Role of IT in Forecasting, Risk Management in Forecasting, Forecasting in Practice.

Aggregate Planning in a Supply Chain: The Role of Aggregate Planning in a Supply Chain, the Aggregate Planning Problem, Aggregate Planning Strategies, Aggregate Planning Using Linear Programming, Aggregate Planning in Excel. The Role of IT in Aggregate Planning, Implementing Aggregate Planning in Practice.

Planning Supply and Demand in a Supply Chain: Managing Predictable Variability, Responding to Predictable Variability in a Supply Chain, Managing Supply, Managing Demand, Implementing Solutions to Predictable Variability in Practice.

UNIT- IV

Planning and Managing Inventories in a Supply Chain: Managing Economies of Scale in a Supply Chain, Cycle Inventory, The Role of Cycle Inventory in a Supply Chain, Economies of Scale to Exploit Fixed Costs, Economies of Scale to Exploit Quantity Discounts, Short-Term Discounting: Trade Promotions, Managing Multiechelon Cycle Inventory, Estimating Cycle Inventory-Related Costs in Practice.

Managing Uncertainty in a Supply Chain: Safety Inventory, The Role of Safety Inventory in a Supply Chain, Determining Appropriate Level of Safety Inventory, Impact of Supply Uncertainty on Safety Inventory, Impact of Aggregation on Safety Inventory, Impact of Replenishment Policies on Safety Inventory, Managing Safety, Inventory in a Multiechelon Supply Chain, The Role of IT in Inventory Management, Estimating and Managing Safety Inventory in Practice.

Determining the Optimal Level of Product Availability: The Importance of the Level of Product Availability, Factors Affecting Optimal Level of Product Availability, Managerial Levers to Improve Supply Chain Profitability, Setting Product Availability for Multiple Products under Capacity Constraints, Setting Optimal Levels of Product Availability in Practice

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UNIT- V

Designing and Planning Transportation Networks: Transportation in a Supply Chain, The Role of Transportation in a Supply Chain, Modes of Transportation and Their Performance Characteristics, Transportation Infrastructure and Policies, Design Options for a Transportation Network Trade-Offs in Transportation Design, Tailored Transportation, The Role of IT in Transportation Risk Management in Transportation, Making Transportation Decisions in Practice.

Managing Cross-Functional Drivers in a Supply Chain: Sourcing Decisions in a Supply Chain, The Role of Sourcing in a Supply Chain, In-House or Outsource, Third- and Fourth-Party Logistics Providers, Supplier Scoring and Assessment, Supplier Selection-Auctions and Negotiations Contracts and Supply Chain Performance, Design Collaboration, The Procurement Process, Sourcing Planning and Analysis, The Role of IT in Sourcing, Risk Management in Sourcing, Making Sourcing Decisions in Practice.

Text Book

1. Supply Chain Management: Janat Shah, Pearson Publications 2010.
2. Supply Chain Management: Sunil Chopra and Mein del, Fourth Edition, PHI 2010.
3. Supply Chain Management: A.S.Altekar PHI Second Ed.2006.
4. Logistics Management: James Stock and Douglas Lambert. McGraw Hill International Ed.2006.
5. Supply Chain Management for Global Competitiveness :Ed.B.S.Sahay McMillan Publication 2000
6. Emerging Trends in Supply Chain Management: Ed.B.S.Sahay McMillan Publication 2000.
7. Logistics Management: Bowersox TMH 2004.

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VIII Sem	IP8-OET...42	Safety Management And Labour Law	4	-	-	4	Max Marks-60 Min Marks- Duration-3Hrs

SAFETY MANAGEMENT AND LABOUR LAW

UNIT -I

Safety Management: Concepts Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. Techniques Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

Safety in Material Handling: Ergonomic consideration in material handling, design, installation, operation and maintenance of Conveying equipment, hoisting, traveling and slewing mechanisms

UNIT -II

Design of Air Pollution Control System: Industrial sources of Air Pollution, Emission factors, Regulations Control Strategies, Policies, Gaseous Pollutant control: Gas absorption in tray and packed towers, Absorption with / without chemical reaction - Removal of SO₂ - Absorption in fixed blades- Breakthrough. Removal of HCs / VOCs - NO_x removal - Wet scrubbers.

Integrated Air pollution control systems: Pollution Control in Process Industries, Pollution control in process industries like cement, paper, petroleum, petroleum products- textile-tanneries-thermal power plants dying and pigment industries - eco-friendly energy

UNIT -III

Safety in Metal Working Machinery and Wood Working Machines: General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planing machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes, saws, types, hazards.

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UNIT -IV

Fire Prevention and Protection: Sources of ignition, fire triangle, principles of fire extinguishing, active and passive fire protection systems – various classes of fires, A, B, C, D, E, types of fire extinguishers, fire stoppers, hydrant pipes, hoses, monitors, fire watchers layout of stand pipes – fire station-fire alarms and sirens, maintenance of fire trucks, foam generators, escape from fire rescue operations, fire drills, notice first aid for burns.

UNIT -V

Explosion Protecting Systems Principles of explosion-detonation and blast waves-explosion, parameters – Explosion Protection, Containment, Flame Arrestors, isolation, suppression, venting, explosion relief of large enclosure-explosion venting-inert gases, plant for generation of inert gas rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO₂) and halons-hazards in LPG, ammonia (NH₃), Sulphur dioxide (SO₂), chlorine (CL₂) etc.

Text Book

1. Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago, 1982
2. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York, 1980.
3. Gupta, R.S., “Hand Book of Fire Technology” Orient Longman, Bombay 1977.
4. “Accident Prevention manual for industrial operations” N.S.C., Chicago, 1982.
5. Dinko Tuhtar, “Fire and explosion protection

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VIII Sem	IP8-OET...43	Finite Element Method	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

FINITE ELEMENT METHOD (FEM)

UNIT-I

Basic Concept of FEM: Historical background, Basic concept and steps in FEM, Mathematical modeling of field problems in engineering, Governing equations, Discrete and continuous models, Boundary and initial value problems, One dimensional second order equation, discretization, Linear and higher order elements, Introduction of FEM software and steps.

Matrix displacement formulation: Matrix displacement equations, solution of matrix displacement equations, techniques of saving computer memory requirements, Finite element formulation.

UNIT-II

Natural Coordinate systems and Shape function: Basic concept of natural coordinate, 1-D and 2- D natural coordinate, Concept of shape functions, Convergence requirements, Pascal triangle, Shape function for linear and plain elements, Shape functions using Lagrange polynomials. Shape functions for serendipity family elements, Degrading technique for nodes.

UNIT- III

Strain displacement matrix: Strain-displacement matrix for linear and plain element, Strain-displacement matrix for beam, Linear and plain elements.

Stiffness Matrix: Concept of element stiffness matrix for linear and plain elements. Stiffness matrix for bar & trusses. Stiffness matrix for linear and plain elements, Force vectors, Body forces and thermal loads, Plate and shell elements, Finite representation of infinite bodies, Element aspect ratio, Quadrilateral and higher order element vs mesh refinement.

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UNIT- IV

Assembling of stiffness Matrix: Assembly of elemental matrices, boundary conditions and solution, Direct approach, Strain energy, Castigliano's first theorem, Minimum potential energy, Galerkin's method, Galerkin's method applied to elasticity problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Isoparametric formulations.

UNIT- V

Finite element Solutions: Numerical integration and application to plane stress problems, Solid mechanics and heat transfer, Longitudinal vibration and mode shapes, Fourth order beam equation, Transverse deflections and natural frequencies, Bar, Trusses & Beams. Plane stress and plane strain problems, Use of higher order elements, Solution of dynamic problems application to thermal problems, torsion of non-circular shafts.

Text Books:

1. K.H Huebner, and E.A., Thorton, "The Finite Element Methods for Engineers" John Wiley & Sons.
2. R.D. Cook, Malkus, D.S. and Plesha, M.E., "Concepts and Applications of Finite Element Analysis", 3 rd Ed., John Wiley & Sons.
3. S.S. Rao, Finite Element Method in Engineering, Butterworth Heinemann.
4. Bathe, K.J., "Finite Element Procedures", Prentice Hall of India, New Delhi.
5. Zienewicz, O.C. and Taylor, R.L., "The Finite Element Methods", Vol.1 and Vol.2, McGraw Hill.
6. S.S.Bhavikatti, Finite element analysis, New Age Pub.
7. J.N., Reddy, An Introduction to Finite Element Method, Tata McGraw Hill
8. P. Seshu, Text Book of Finite Element Analysis, Prentice Hall, New Delhi.

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VIII Sem	IP8-PET...71	Fluid Power Control	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

FLUID POWER CONTROL

UNIT -I

Introduction –what is fluid power, application of fluid power, component of fluid power system. Force pressure and head .Specific weight, density specific gravity, bulk modulus, viscosity, viscosity index.

Energy and Power in Hydraulic System: Pascal's law, continuity equation, conservation of energy, hydraulic power, Bernoulli's equation, Torricelli's theorem, the siphon. Energy power and flow rate in the SI units.

UNIT -II

Hydraulic pumps- introduction pumping theory, pumps classification, gear pump, vane pump, piston pump, pump Performance, pump Noise, pump selection , pump performance rating in SI unit.

Hydraulic Cylinders and cushioning-Introduction, Hydraulic Cylinders operating features, Cylinders mounting and mechanical linkage. Cylinder loads due to moving weights, special cylinder designs, cylinder loading through mechanical linkage, hydraulic cylinder cushions, and hydraulic shock absorber.

UNIT -III

Hydraulic motors: Introduction, limited rotation Hydraulic motors, gear motors, vane motors, Hydraulic motors theoretical torque, power and flow rate, Hydraulic motors performance, Hydraulic transmission, Hydraulic motors performance in metric unit.

Hydraulic valve: Hydraulic components -pressure-flow-direction controls valves –proportional, servo, cartridge (logic) valves. Hydraulic fuses

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UNIT -IV

Hydraulic Conductor and Fittings: Introduction, conductor sizing for flow rate requirement, pressure rating of conductors, steel pipes, steel tubing, plastic tubing, flexible hoses, quick disconnect couplings, metric steel tubing .

Hydraulic Circuit Design and Analysis: Introduction, control of single and double acting hydraulic cylinder, pump hydraulic system, circuit, valve application, speed control of motor and cylinder, motor braking system, analysis of hydraulic system

UNIT -V

Pneumatics: Air preparation & components: Introduction, compressor, fluid conditioner, analysis of moisture removal from air, air control valves, Pneumatic actuators.

Pneumatic circuits and applications: design consideration, pressure losses in pipe lines, circuits, vacuum system, analysis

Text books

1. Fluid power with application by Anthony Esposito by PHI publication
2. Oil hydraulic system by Majumdar by TMC publication

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VIII Sem	IP8-PET...72	Robotics and Robot Applications	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

ROBOTICS AND ROBOT APPLICATIONS

UNIT - I

Introduction to Robotics: Evolution of robots and robotics, progressive advancement in robots, definitions and classifications, laws of robotics, robot anatomy and related attributes, repeatability, accuracy and precision, human arm characteristics, robot specification and notations, concept of robots programming, the future prospects.

UNIT - II

Coordinate Frames, Mapping and Transforms : Coordinate frames, Spatial descriptions and transformations, Fundamental of translation, rotations and transformations, inverting a homogeneous transform, fundamental rotation matrices, yaw pitch and roll, yaw pitch and roll transformation, equivalent angle.

UNIT - III

Symbolic Modeling of Robots, Direct Kinematic Model: Mechanical structure and notations, description of links and joints, kinematic modeling of the manipulator, Denavit, Hartenberg (D-H) representation, kinematic relationship between adjacent links, manipulator, transformation matrix, Arm equations.

UNIT - IV

Robotic Sensors and Vision: The meaning of sensing, sensors in robotics, kinds of sensors used in robotics, robotic vision, industrial applications of vision-controlled robotic systems, process of imaging, architecture of robotic vision systems, image acquisition, description of other components of vision system, image representation, image processing, Artificial Intelligence (AI) in robotics.

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UNIT - V

Robot Controller & Applications: Linear control of robot manipulation, Feedback and close loop control, Second-order linear systems, Trajectory following control, Modelling and control of single joint, Architecture of industrial robotic controllers, Artificial intelligence, Industrial and non-industrial applications, robotic application for sustainable development & social issues.

Text Books

1. Robotics & Control – R.K. Mittal & I.J. Nagrath – TMH Publications
2. Robotics for engineers - Yoram Korean- McGrew Hill Co.
3. Industrial Robotics Technology programming and Applications - M.P.Groover, M.Weiss,
4. Robotics Control Sensing, Vision and Intelligence - K.S.Fu, R.C.Gonzalez, C.S.G.Lee- McGrew Hill Book co.
5. Kinematics and Synthesis of linkages - Hartenberg and Denavit - McGrew Hill Book Co
6. Kinematics and Linkage Design - A.S. Hall - Prentice Hall
7. Kinematics and Dynamics of Machinery - J.Hirchhorn - McGrew HillBook Company

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Category of Course	Course Code	Course Title	Periods/Week				Theory Paper
			L	T	P	C	
Industrial & Production Engg. B. TECH- VIII Sem	IP8-PET...73	Powder Metallurgy and Ceramics	3	1	-	4	Max Marks-60 Min Marks- Duration-3Hrs

POWDER METALLURGY AND CERAMICS

UNIT - I

Introduction: Steps In powder metallurgy, advantage application limitation and recent trends.

Powder production methods and Properties: Metal production methods: Aromatization, Mechanical (Milling), Electro deposition, Spray drying. Powder Treatment- Screening, cleaning, annealing, and lubrication. Powder treatment and handling , coating and pyrophoracity, toxicity

UNIT - II

Characterization of metal powder: Sampling of metal powder, particle size and size distribution. Particle shape analysis, surface area, density and porosity, apparent density, tap density.

Compaction and shaping: powder pressing, compaction method, classification of parts. Cold Iso-static compaction, powder rolling. High temperature compaction – principle of pressure sintering

UNIT - III

Sintering and consolidation: Sintering, types of Sintering, theory of Sintering, Sintering of multi components, effect of Sintering, porosity in Sintered part, Sintering atmosphere, Sintering furnaces, metallographic of Sintering parts.

PM Products and their Applications: Electrical and magnetic applications (Resistance welding electrode, Metal graphite brushes, Tungsten etc), PM porous parts, PM Friction materials, Metal bearings, Dispersions strengthened materials ,Cutting tool materials, Cemented carbides and tools, cermet.

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UNIT - IV

Ceramics- Introduction and major applications, Nature and structure of ceramics, types and general characteristics of ceramics- oxide ceramics, carbides, nitrides, silica, glasses, graphite and diamond.

UNIT - V

Advance powder metallurgical process technique- atomization and its types , process parameters and characteristics, mechanical alloying , process types and parameter , metal injection molding , steps, requirement, design application and defect .

Microwave sintering of metals - Applications in electrical and electronics including high temperature superconductors, frictional ceramics, refractory, Fabrication methods of ceramics.

Text Books:

1. Powder metallurgy by P.C.angelo, R. subramanian by PHI publication
2. Fundamentals of Powder Metallurgy :G.S.Upadhaya Cambridge International Science Publishing 1998
3. Fundamentals Principles of Powder Metallurgy : W.B.Jones Edward Arnold Publishing
4. First Course in Powder Metallurgy: Henry Hauser Chemicals Publishing Company
5. Handbook Of Powder Metallurgy : Hausner H.H and Mal M.K. Second Edition , Chemicals Publishing Company
6. Metals Handbook Vol.7 Powder Metallurgy : ASM 1998

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SCHEME OF EXAMINATION										
B.TECH (FOUR YEAR) DEGREE COURSE										
FIRST YEAR , INDUSTRIAL PRODUCTION ENGINEERING										
SEMESTER II (COURSE-A)										
EFFECTIVE FROM SESSION 2018-19										
SL. NO.	SUBJECT CODE	SUBJECTS	PERIODS/WEEK			EVALUATION SCHEME			CREDITS	
			L	T	P	IA	ESE	TOTAL		
THEORY										
1	IP02TBS03	PHYSICS	3	1	0	30	70	100	4	
2	IP02TES03	BASIC ELECTRICAL ENGINEERING	3	1	0	30	70	100	4	
3	IP02TBS04	MATHEMATICS-I	3	1	0	30	70	100	4	
4	IP02THS01	ENGLISH	3	0	0	30	70	100	3	
5	IP02THS02	ENVIRONMENTAL SCIENCES	3	0	0	0	
PRACTICAL										
1	IP02PBS02	PHYSICS LAB	0	0	3	30	20	50	1.5	
2	IP02PES04	BASIC ELECTRICAL ENGINEERING LAB	0	0	2	30	20	50	1	
3	IP02PES05	ENGINEERING GRAPHICS & DESIGN	1	0	3	30	20	50	2.5	
TOTAL									20	
IA – INTERNAL ASSESSMENT ESE – END SEMESTER EXAM. L- LECTURE T-TUTORIAL P-PRACTICAL										

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Subject code/SUBJECT	L	T	P	Credit
IP01TBS01/MATHEMATICS-II	3	1	0	4

Module 5a: First order ordinary differential equations(6 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 5b: Ordinary differential equations of higher orders (Prerequisite 2c, 4a) (8 hours)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 5c: Partial Differential Equations-First order(Prerequisite 5a-b) (6 hours)

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Module 5d: Partial Differential Equations- Higher order(Prerequisite 5b-c) (10 hours)

Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
7. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
8. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
9. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
10. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010
11. Denian murry, differential equations, oxford publications

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SUBJECT CODE/NAME	L	T	P	Credit
IP01TBS02/CHEMISTRY	3	1	0	4

Unit-I Concept of Quantum Energy and Spectroscopy: Quantization of Energy, Regions of spectrum. Electronic Spectroscopy: Electronic Transition, Woodward Fiesher rules for calculating λ_{\max} of conjugated dienes & α, β -unsaturated carbonyl compound, various shifts in λ_{\max} and intensities. Infra Red Spectroscopy: Conditions for Infra Red Spectroscopy, Molecular vibrations & factors affecting Infra Red frequencies. [8 L]

Unit-II Chemical Bonding in Molecules: Introduction of chemical bonding, VSEPER Theory, V.B.Theory and Molecular Orbital Theory, Energy level diagrams of diatomic molecules and ions. [16 L]

Unit-III Concept of Chirality, Enantiomers, Diastereomers, Meso-compounds and Racemic mixtures. Conformation of Acyclic hydrocarbons (Ethane, Propane & n-Butane) and Cyclic hydrocarbon (Cyclohexane), Plane of symmetry, Center of symmetry, Absolute and Relative Configuration (R & S, D & L and E & Z). [8 L]

Unit-IV Reactivity of Organic Molecules, Factors influencing acidity, basicity and nucleophilicity of molecules, kinetic vs thermodynamic control of reactions. [12 L]

Unit-V Strategy for Synthesis of Organic Compounds: Reaction intermediates: Stability of Free Radical, Carbocation and Carbanion. Introduction to reaction involving Addition, Elimination, Substitution and Ring opening and Cyclization. [16 L]

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Subject code/NAME	L	T	P	Credit
IP01TES01/PROGRAMMING FOR PROBLEM SOLVING	3	0	0	3

Unit 1

Introduction to Programming (3 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) -

Idea of Algorithm (3 lectures) : steps to solve logical and numerical problems.

Representation of Algorithm: Flowchart/Pseudo code with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Unit 2

Arithmetic expressions and precedence (12 lectures)

Conditional Branching and Loops

Writing and evaluation of conditionals and consequent branching

Iteration and loops

Arrays (6 lectures) Arrays (1-D, 2-D), Character arrays and strings

Unit 3

Basic Algorithms (6 lectures)

Searching ,concept of binary search etc , Basic Sorting Algorithms Bubble sort etc, Finding roots of equations, introduction of Algorithm complexity

Unit 4

Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference binary search etc

Recursion functions (5 lectures) Recursion, as a different way of solving problems.

Example programs, such as Finding Factorial, Fibonacci series, etc.

Unit 5

Structure (4 lectures)

Structures, Defining structures and Array of Structures

Pointers (3 lectures) Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Suggested Text Books

- (i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- (ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

- (i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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SUBJECT CODE/SUBJECT	L	T	P	Credit
IP01TES02/ENGINEERING MECHANICS	3	0	0	3

ENGINEERING MECHANICS

UNIT-I

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar, Concurrent Forces, Components in Space-Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II

Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies.

Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; Simple Trusses; Zero force members.

UNIT-III

Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.

UNIT-IV

Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, mechanical efficiency.

Review of particle dynamics- Rectilinear motion; Newton's 2nd law (rectangular and path). Work-kinetic energy, power, potential energy. Impulse-momentum; Impact (Direct and oblique).

UNIT-V

Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

Text/Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, -Dynamics, 9th Ed, Tata McGraw Hill
3. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
4. Shames and Rao (2006), Engineering Mechanics, Pearson Education,
5. Bansal R.K. (2010), A Text Book of Engineering Mechanics, Laxmi Publications
6. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
7. Tayal A.K. (2010), Engineering Mechanics, Umesh Publication

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SUBJECT CODE/SUBJECT	L	T	P	Credit
IP01PBS01/CHEMISTRY LAB	0	0	3	1.5

List of Experiments:

Group – A:

1. Standardization of sodium thiosulphate solution by standard potassium dichromate solution.
2. To determine the Normality and Strength (g/L) of given Ferrous Ammonium Sulphate solution 'A' using standard Ferrous Ammonium Sulphate (N/30) solution 'B' taking KMnO₄ solution as an intermediate.
3. To determine the concentration of hypo solution (Na₂S₂O₃.5H₂O) iodometrically with given Iodine (N/50) solution.
4. Find out the Temporary hardness of given water sample using 0.01M EDTA solution, buffer solution (pH-10) and EBT as an indicator.
5. To determine chloride ion in a given water sample by Argentometric method (Mohr's method)

Group – B:

6. Preparation of Urea Formaldehyde resin.
7. Acetylation of Primary Amine: Preparation of Acetanilide.
8. Base Catalyzed Aldol Condensation: Synthesis of Dibenzalpropanone.
9. [4+2] Cycloaddition Reaction: Diels-Alder reaction.
10. Preparation of Aspirin and calculate its yield.

Group – C:

11. To calculate the λ_{max} of a given compound using UV-visible spectrophotometer.
12. To separate the metallic ions by paper chromatography.
13. To determine the surface tension of a liquid by stalagmometer.
14. To determine the percentage composition of the given mixture consisting of two liquids A and B (non interacting system) by viscosity method.
15. To determine the relative viscosity of given liquids by Ostwald's viscometer.

Note: At least two Experiments from each group must be performed.

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SUBJECT CODE/NAME	L	T	P	Credit
IP01PES01/PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	3	1.5

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:

Lab 1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

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SUBJECT CODE/NAME	L	T	P	Credit
IP01PES02/ WORKSHOP & MANUFACTURING PRACTICES	1	0	3	2.5

Lectures & videos 10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Suggested Text/Reference Books:

- (i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
- (ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
- (iii) Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology-I" Pearson Education, 2008.
- (iv) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
- (v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

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SUBJECT CODE/SUBJECT	L	T	P	Credit
IP01 PES03/ENGINEERING MECHANICS LAB	0	0	2	1

Engineering Mechanics - Lab

List of Experiments

1. Verification of law of parallelogram of forces.
2. Verification of law of triangle of forces.
3. Verification of law of polygon of forces by universal force table.
4. Verification of law of moment by parallel forces apparatus.
5. Practical verification of forces in the member of jib crane.
6. Practical verification of forces in the member of the truss.
7. Determination of coefficient of friction between two given surfaces by inclined plane method.
8. Determination of efficiency of simple screw jack.
9. Determination of efficiency of single purchase winch crab.
10. Determination of efficiency of double purchase winch crab.
11. Determination of efficiency of simple wheel and axle.

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SUBJECT CODE/SUBJECT	L	T	P	Credit
IP02TBS03/PHYSICS	3	1	0	4

Unit - 1: Optics: Interference and Diffraction

Introduction, Young's experiment, theory of interference, Coherent and non-coherent sources, Fresnel's Bi-prism and Newton's ring experiment.

Diffraction of light, Fresnel and Fraunhofer's diffraction, diffraction due to plane diffraction grating.

Unit - 2: Electromagnetic Theory

Coulomb's law, electrostatics field and potential, electric flux, Gauss' law, Poisson's and Laplace's equation, Equation of continuity for charge conservation, Ampere's and Faraday's laws, Maxwell's Electromagnetic equations.

Unit - 3: Laser and Fiber optics

Introduction, elementary idea of spontaneous and stimulated emission, active medium, population inversion, Einstein's coefficients, Types of lasers and important applications of lasers.

Introduction to optical fibers, basic principles of optical fiber, critical angle, numerical aperture, maximum acceptance angle, classification of optical fiber.

Unit -4: Semiconductor Physics and Devices

Formation of energy in solids, Energy band gap of metals, insulators and semiconductors, classification of semiconductor: Intrinsic and Extrinsic semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Electrical conductivity in conductors and semiconductors, working of P-N Junction diodes and Bipolar Junction transistor.

Unit - 5: Introduction to Quantum Mechanics

Introduction to QuantumMechanics, Photoelectric effect, Compton effect, wave-particle duality, uncertainty principle, wave function, De-Broglie waves, Phase and Group velocity, Davisson and Germer experiment, Schrodinger wave equation, particle in a box (1-Dimensional).

Text Books and References

- 1) Applied Physics – I and II by Navneet Gupta, Dhanpat Rai & Co.
- 2) Engg. Physics by S. K. Srivastava and R. A. Yadav, New Age Pub. New Delhi
- 3) Engg. Physics by Uma Mukherjee, Narosa Publication
- 4) Engg. Physics by M. N. Avadhanulu, S. Chand Pub.
- 5) Electricity and Magnetism by Rangwala and Mahajan, Tata McGraw Hill, 1998
- 6) Concepts of Physics Part -II by H. C. Verma, BharatiBhawan (P&D), 1998
- 7) Modern Physics by Beiser, McGraw Hill Inc. New York, Publication 1995
- 8) Modern Physics by Mani and Mehta, East-West Press Pvt. Ltd. 1998
- 9) Introduction to Electrodynamics, David Griffith
- 10) J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
- 11) B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., 2007).
- 12) S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
- 13) Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
- 14) P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
- 15) Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
- 16) Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

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SUBJECT CODE/NAME	L	T	P	Credit
IP02TES03/ BASIC ELECTRICAL ENGINEERING	3	1	0	4

Module 1 : DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase Balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC bucks and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

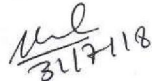
Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

- D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
- L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
- E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
- V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.


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Subject code	L	T	P	Credit
IP01TBS01/ MATHEMATICS-I	3	1	0	4

Calculus (Single Variable)

Module 2a: Calculus: (6 hours)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Asymptotes: definition, properties and problems.

Module 2b: Calculus: (6 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 2c: Sequences and series: (Prerequisite 2b) (10 hours)

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11 Reprint, 2010.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Multivariable Calculus

Module 3a: Multivariable Calculus (Differentiation) (Prerequisite 2b) (10 hours) Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 3b: Multivariable Calculus (Integration) (Prerequisite 3a) (10 hours)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11 Reprint, 2010.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Matrices and Linear Algebra

Module 4a: Matrices (in case vector spaces is not to be taught) (14 hours)

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Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Module 4b: Matrices (in case vector spaces is to be taught) (8 hours)

Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Module 4c: Vector spaces (Prerequisite 4b) (10 hours)

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank nullity theorem, composition of linear maps, Matrix associated with a linear map.

Module 4d: Vector spaces (Prerequisite 4b-c) (10 hours)

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Textbooks/References:

- 1.D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- 2.V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East-West press, Reprint 2005.
- 3.Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- 4.Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- 5.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- 6.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

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Subject code	L	T	P	Credit
IP02THS01/ ENGLISH	3	0	0	3

1. Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

4. Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

5. Writing Practices

Comprehension, Précis Writing, Essay Writing.

6. Oral Communication (This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

- (i) Practical English Usage. Michael Swan. OUP. 1995.
- (ii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (iv) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

MS
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CODE/SUBJECT	L	T	P	CREDIT
IPO2TMC01/ENVIRONMENTAL SCIENCES	3	0	0	0

ENVIRONMENTAL STUDIES

ERR-4 NC 04 classes
(Shwari)

Introduction to environmental studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. Ecosystems: Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), Natural Resources Renewable and Non-renewable Resources: Land resources and land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies. Biodiversity and Conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India;

Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value. Environmental Pollution: Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case studies. Environmental Policies & Practices. Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, human wildlife conflicts in Indian context. Human Communities and the Environment, Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements Chipko, silent valley, Bishnois of Rajasthan. Environmental ethics: role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Field work: Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river etc.

Suggested Readings:

1. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
2. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36--37.
3. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
4. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.

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SUBJECT CODE/SUBJECT	L	T	P	Credit
IP02PBS02/PHYSICS LAB	0	0	3	1.5

List of Experiments:

1. To determine the wavelength of sodium light with help of Fresnel's Bi-prism.
2. To determine the refractive index and dispersive power of the material of prism with the help of spectrometer.
3. To determine the sodium light by Newton's ring method.
4. To determine the wavelength of sodium light by plane diffraction grating using spectrometer.
5. To demonstrate the diffraction pattern and determine the wavelength of different colors of mercury (white) light using plane diffraction grating and spectrometer.
6. To determine the wavelength and number of lines per cm on a diffraction grating using semiconductor laser diode.
7. To determine the specific rotation of sugar solution with the help of polarimeter.
8. Determine the width of the single slit and diameter of circular aperture using Fraunhofer diffraction pattern produced by semiconductor laser diode.
9. To determine the Energy band gap (E_g) of a semiconductor material using P-N junction diode.
10. To determine the e/m ratio by Thomson's method
11. To study the P-N junction diode characteristics, in forward and reverse bias conditions.
12. To study the Zener diode characteristics.
13. To study the characteristics and gain of Transistor in C-B and C-E mode.
14. Determine the Planck's constant.

Md
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SUBJECT CODE/NAME	L	T	P	Credit
IP02PES04/ BASIC ELECTRICAL ENGINEERING LAB	0	0	2	1

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments—voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
- Sinusoidal steady state response of R-L, and R-C circuits—impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shaped due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
- Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters—PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

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SUBJECT CODE/SUBJECT	L	T	P	Credit
IP02PES05/ENGINEERING GRAPHICS & DESIGN LAB	1	0	3	2.5

ENGINEERING GRAPHICS & DESIGN

UNIT-I

Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales - Plain, Diagonal and Vernier Scales.

UNIT-II

Orthographic Projections

Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes.

Projections of Regular Solids

Inclined to both the Planes - Auxiliary Views; Draw simple annotation, dimensioning and scale.

UNIT-III

Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid, Cone - Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT-IV

Isometric Projections covering,

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

UNIT-V

Overview of Computer Graphics

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids].

Suggested Text/Reference Books:

- (i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
- (ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- (iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- (iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
- (v) (Corresponding set of) CAD Software Theory and User Manuals

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING, GGVV, BILASPUR CG

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TPE51	Fundamentals of Green Manufacturing	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To originate engineering skills to identify, formulate, and solve industrial process problems.
- To demonstrate the concept of organization, production systems and cost analysis.
- To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
- To develop an ability to apply PPC concepts in a various areas like marketing, accounting, finance, engineering, personnel management, logistics, etc.
- To integrate operations concepts with other functional areas of business and to compile several important contemporary topics relevant to business managers under functional disciplines, including quality management, production concepts, and sustainability issues.
- To evaluate the PPC function in both manufacturing and service organizations and to examine several dilemmas related to operations management, production planning and inventory control.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

- Recognize the objectives, functions and applications of Production management and allied techniques.
- Categorize and solve different inventory control techniques, forecasting dilemmas, routing problems and scheduling troubles.
- Summarize various aggregate production planning techniques and integrating them to different departments to execute effective PPC functions.
- Inspect organizational performance, production systems, demand trends, location feasibility and cost analysis.
- Elaborate and estimate methods of line balancing, process sheets, production strategies, sales forecasting and maintenance.

COURSE CONTENT:



DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING, GGVV, BILASPUR CG

MODULE-I

Introduction: Sustainable development, indicators of sustainability, sustainability strategies, sustainable manufacturing, evolution of sustainable manufacturing, elements of sustainable manufacturing, theory of green manufacturing and its principles, need for green manufacturing, drivers and barriers of green manufacturing.

MODULE - II

Green manufacturing strategy: Manufacturing strategy, elements of manufacturing strategy, manufacturing outputs, competitive priorities: quality, delivery speed and reliability, cost efficiency, flexibility, order winners and order qualifier, tradeoff, production systems, manufacturing levers, competitive analysis, level of manufacturing capability, framework for formulating manufacturing strategy, implications of green manufacturing for manufacturing strategy.

MODULE - III

Life cycle approach of green manufacturing: Holistic and total Life-cycle approach, six step methodologies for green manufacturing (6-R approach), life cycle assessment (LCA), elements of LCA, life cycle costing, eco labelling target setting, data collection and processing, final evaluation by virtue of criteria, environmental management systems.

MODULE - IV

Green manufacturing technology: Definition of green manufacturing technology and practices, classifications of green manufacturing technology, advantages and disadvantages of implementation of green technology.

MODULE - V

Lean and Green manufacturing: Introduction, lean evolution & steps, introduction to lean manufacturing, definition of lean manufacturing, lean vs. green manufacturing: similarities and differences.

TEXT & REFERENCE BOOKS:

1. Cleaner Production: Environmental and Economic Perspectives, Misra Krishna B., Springer, Berlin, Latest edition.
2. Environmental Management Systems and Cleaner Production, Dr. Ruth Hillary, Wiley, New York, Latest edition.
3. Pollution Prevention: Fundamentals and Practice, Paul L Bishop, TMH.
4. Costing the earth, Cairncross and Francis, Harvard Business School Press - 2009.
5. The principle of sustainability, Simon Dresner, -Earth Scan publishers (2008).
6. Manufacturing strategy: How to formulate and implement a winning plan, Jhon Miltenburg, Productivity Press Portland, Oregon-2017.



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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TOE21	Advanced Manufacturing Processes	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the principle of various advanced machining processes kinematics drive of machine tool.
- To impart knowledge about cutting different material removal, joining processes.
- To understand about various advanced metal forming processes.
- Explain how to identify suitable hybrid welding processes for joining dissimilar materials.
- To understand about various advanced casting processes.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Analyze real-life application in various organizations.
- Categorize different material removal, joining processes as per the requirements of material being used to manufacture end product.
- Choose material processing technique with the aim of cost reduction, reducing material wastage & machining time.
- Estimate process parameters affecting the product quality in various advanced machining of metals/ non-metals, ceramics and composites.

COURSE CONTENT:

MODULE – I

Advanced machining processes: Introduction, micro machining process, principle, material removal mechanism, parametric analysis and applications of processes such as ultrasonic machining (USM), abrasive jet machining (AJM), water jet machining (WJM), abrasive water jet machining (AWJM), electrochemical machining (ECM), electro discharge machining (EDM), electron beam machining (EBM), laser beam machining (LBM) processes, working principle of plasma arc machining.

MODULE – II

Advanced machining theory & practices: Mechanisms of chip formation, shear angle relations, and theoretical determination of cutting forces in orthogonal cutting, analysis of turning, drilling and



DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING, GGVV, BILASPUR CG

milling operations, mechanics of grinding, dynamometry, thermal aspects of machining, tool wear, economics of machining, processing of polymers, ceramics, and composites.

MODULE – III

Advanced metal forming processes: Details of high energy rate forming (HERF) process, electro-magnetic forming, explosive forming electro-hydraulic forming, stretch forming, contour roll forming.

MODULE – IV

Advanced welding processes: Details of electron beam welding (EBW), laser beam welding (LBW), ultrasonic welding (USW), cold welding, diffusion welding, forge welding, friction welding, explosive welding, hard vacuum welding, soft vacuum welding, underwater welding processes, concept of robotized welding and welding automation.

MODULE -V

Advanced casting processes: Metal mould casting, continuous casting, squeeze casting, vacuum mould casting, evaporative pattern casting, ceramic shell casting.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for Engineering Materials, Serope Kalpakjian, Steven R. Schemid, Fourth edition, Pearson Education.
2. Manufacturing Engineering and Technology, Serope Kalpakjian, Third Edition, Addison-Wesley Publication Co.,
3. Materials and Processes in Manufacturing, E.P. DeGarmo, J. T Black, R.A. Kohser, 8th Edition, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
4. Manufacturing Science, A. Ghosh & A.K. Mallik, East-West Press Pvt. Ltd. New Delhi.
5. Non-traditional Manufacturing Processes, G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7)
6. Advanced Machining Processes, V.K. Jain, Allied Publishers Pvt. Ltd.
7. Modern Machining Processes, P.C Pandey & H.S. Shan, McGraw Hill Education.
8. Manufacturing Technology, P. N Rao, Tata McGraw Hill Publishing Company.
9. Non-Conventional Machining, P. K Mishra, Narosa Publishers.
10. Unconventional Manufacturing Processes, K. K Singh, Dhanpat Rai & Company, New Delhi.



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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP07TOE23	Maintenance Management	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To develop the skill of maintenance functions in industry.
- To provide the concept of various types of maintenance system used in industries.
- To impart knowledge on reasons for failure and the corrective and preventive measure adopted to reduce them.
- To create the ability of data, analyze failure cause and reliability engineering.
- To develop the new techniques of maintenance for minimizing the cost of maintenance and improving of life of equipment's.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Understand and be able to explain the aim and basics of maintenance activity.
- Use various methods of maintenance and procedures applied to equipment's.
- Be aware of methods of detection for faults and errors in operations.
- Apply the tools and techniques of repairing, faults analysis.

COURSE CONTENT:

MODULE - I

Introduction: Fundamentals of maintenance engineering, maintenance engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. safety regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000.

MODULE - II

Maintenance management: Types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance and their comparison, advantages & disadvantages, limitations of computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department.

MODULE - III



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Tribology in maintenance: Friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes.

Lubricants: Types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packing.

MODULE - IV

Machine health monitoring: Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, instrumentation & equipment used in machine health monitoring. instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.

TPM: Introduction, history, components, pillars of TPM, calculation of OEE, Terri technology.

MODULE - V

Reliability, availability & maintainability (RAM) analysis: Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non-repairable systems, improvement in reliability, reliability testing, reliability prediction, utilization factor, system reliability by Monte Carlo simulation technique, FMECA.

TEXT & REFERENCE BOOKS:

1. Maintenance Engineering Hand Book, Higgins.
2. Maintenance & Spare parts Management, Gopal Krishnan.
3. Industrial Maintenance Management, S.K. Shrivastava.
4. Industrial Engineering, Hand book of Condition Monitoring, C.N.R. Rao.



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GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY

Department of Industrial & Production Engineering

CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2021-22

B. TECH FOURTH YEAR, VIII SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP08TPC16	Robotics and Robot Applications	3	1	-	30	70	100	4
2.	IP08THS04	Electives from Humanity Science-04	3	-	-	30	70	100	3
3.	IP08TOE03	Open Elective-03	3	-	-	30	70	100	3
4.	IP08TOE04	Open Elective-04	3	-	-	30	70	100	3
5.	IP08TMC03	Essence of Indian Traditional Knowledge	3	-	-	-	-	-	-
Total			15	1	-	120	280	400	13
PRACTICALS									
1.	IP08PPR02	Major Project	-	-	12	120	80	200	6
2.	IP08PPC01	Comprehensive Viva	-	-	-	-	50	50	2
Total			-	-	12	120	130	250	8

Total Credits: **21**

Total Contact Hour: **28**

Total Marks: **650**

INTERNAL ASSESSMENT: -two class tests of 15 marks each will be conducted.

L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP08THS04 Electives from Humanity Science-04
IP08THS41 Intellectual Property Rights
IP08THS42 Safety Management and Labour Law
IP08TOE03 Open Elective-03
IP08TOE31 Computer Aided Process Planning
IP08TOE32 Microprocessors in Automation
IP08TOE04 Open Elective-04
IP08TOE41 Supply Chain Management
IP08TOE42 Composite Materials Technology



Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech VIII Sem.	IP08THS41	Intellectual Property Rights	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Understand, define and differentiate various types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
- Understand the framework of strategic management of Intellectual Property (IP).
- Appreciate and appraise different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs.
- Explain how to derive value from IP and leverage its value in new product and service development.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Identify the different types of Intellectual properties (IPs), the right of ownership and scope of protection.
- Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
- Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautions steps to be taken to prevent infringement of proprietary rights in products and technology development.
- Analyze ethical and professional issues which arise in the intellectual property right context.
- Apply intellectual property right principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual property rights.
- Demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under



DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING, GGVV, BILASPUR CG

intellectual property law as applicable to information, ideas, new products and product marketing.

COURSE CONTENT:

MODULE - I

Introduction to intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

MODULE - II

Trademarks: Purpose and function of trademarks, acquisition of trademarks rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

MODULE - III

Law of copyrights and law of patents: Fundamentals of copyrights law, originality of material, rights to reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright law, foundation of patent law, patent searching process, ownership rights and transfer.

MODULE - IV

Trade secrets and unfair competition: Trade secrets law, determination of trade secrets status, liability for misappropriations of trade secrets, protection for submission, trade secrets litigation, misappropriation of right of publicity and false advertising.

MODULE - V

New developments of intellectual property: New developments in trade law, copyright law, patent law, intellectual property audits international overview of intellectual property, international-trademark law, copyright law, international patent law, international development in trade secrets law.

TEXT & REFERENCE BOOKS:

1. Intellectual Property Right, Deborah. E. Bouchoux, 4th Edition, 2013, Cengage Learning.
2. Intellectual Property Right: Unleashing the Knowledge Economy, Prabuddha Ganguli, 3 rd Edition, 2005, Tata McGraw Hill Publishing Company Ltd.,



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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TOE31	Computer Aided Process Planning (CAPP)	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this Course is to:

- Learn the fundamentals of computer aided process planning, group technology and applications.
- Study the simulation of machining processes, importance of design and manufacturing tolerances.
- Understand the role of optimal selection of machining parameters.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Generate the structure of automated process planning system and uses the principle of generative and retrieval CAPP systems for automation.
- Select the manufacturing sequence and explains the reduction of total set up cost for a particular sequence.
- Predict the effect of machining parameters on production rate, cost and surface quality and determines the manufacturing tolerances.
- Explain the generation of tool path and solve optimization models of machining processes.
- Create awareness about the implementation techniques for CAPP.

COURSE CONTENT:

MODULE -I

Introduction to CAPP: Information requirement for process planning system, role of process planning, advantages of conventional process planning over CAPP, structure of automated process planning system, feature recognition, methods.

MODULE – II

Generative CAPP system: Importance, principle of generative CAPP system, automation of logical decisions, knowledge-based systems, inference engine, implementation, benefits.

Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications.



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MODULE – III

Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples.

MODULE – IV

Determination of machining parameters: Reasons for optimal selection of machining parameters, effect of parameters on production rate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

MODULE – V

Generation of tool path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods.

TEXT & REFERENCE BOOKS:

1. Automation, Production systems & Computer Integrated Manufacturing System, Mikell P. Groover, PHI Publication.
2. Computer Aided Engineering, David Bedworth, TMH Publishers
3. Computer Aided Design and Manufacturing, Sadhu Singh, Khanna Publisher.
4. Computer Aided Process Planning, H.P. Wang and J.K. Li, Elsevier Science and Technology Publishers, 1st edition, 1991.
5. Computer Aided Process Planning, Joseph Tulkoff, SME Publications.



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Course Name & Semester	Course No.	SUBJECT	PERIOD S			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TOE32	Microprocessors in Automation	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the fundamentals of PIC microcontroller.
- Understand the working of microcontroller systems and able to determine its hardware and software.
- Interface with real time systems.
- Understand the design application based on microprocessors systems.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Learn embedded system and its applications in industry.
- Recognise working of microcontroller architecture and programming model.
- Identify the concept of timer, interrupt, I/O port interfacing with microcontroller.
- Study the concept of interfacing with real time system.

COURSE CONTENT:

MODULE - I

Number Systems: Codes, digital electronics, logic gates, combinational circuits design, flip-flops, sequential logic circuits design, counters, shift registers.

Introduction to 8085 functional block diagram, registers, ALU, bus systems, timing and control signals.

MODULE - II

Machine cycles: Instruction cycle and timing states, instruction timing diagrams, memory interfacing.

MODULE - III

Assembly language programming: Addressing modes, instruction set, simple programs in 8085, concept of interrupt, need for interrupts, interrupt structure, multiple interrupt requests and their handling, programmable interrupt controller, interfacing peripherals, programmable peripheral interface (8255).

MODULE - IV

Interfacing analog to digital converter & digital to analog converter, multiplexed seven segments LED display systems, stepper motor control, data communication: serial data communication (8251),



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programmable timers (8253), 8086/8088 microprocessor and its advanced features.

MODULE - V

Introduction to digital control: Sampling theorem, signal conversion and processing, Z-transform, digital filters, implementation of digital algorithm.

TEXT & REFERENCE BOOKS:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited.
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, Tata McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall.



Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP08TMC03	Essence of Traditional Knowledge	3	-	-	-	-	-	-	-

COURSE LEARNING OBJECTIVES:

- The course aims at imparting basic principles of thought process, reasoning and inferencing. sustainability is at the core of Indian traditional knowledge systems connecting society and nature.
- Holistic life style of yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian knowledge system, Indian perspective of modern scientific world-view and basic principles of yoga and holistic health care system.

COURSE OUTCOMES:

- Ability to understand, connect up and explain basics of Indian traditional knowledge modern scientific perspective.

COURSE CONTENT:

- Basic structure of Indian knowledge system: अष्टादशविद्या -ऋग्वेद, ऋजुवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि) ऋग्वेदांग (शिक्षा, कल्प, निरुक्त, ज्योतिष, छंद) ऋजुवेदांग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र).
- Modern science and Indian knowledge system.
- Yoga and holistic health care.
- Case studies.

TEXT & REFERENCE BOOKS:

1. Cultural Heritage of India-course material, V. Sivaramakrishnan (Ed.), Bharatiya Vidya Bhavan, Mumbai 5th Edition, 2014.
2. Modern Physics and Vedant, Swami Jitmanand, Bharatiya Vidya Bhavan.
3. Tao of Physics, Fritz of Capra.
4. Tarkasangraha of Annam Bhatta, V.N. Jha (Eng. Trans.), International Chinmay Foundation, Velliarnad, Arnakulam.
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Yoga-darshanam with Vyasa Bhashya, G.N. Jha (Eng. Trans.), Ed. R.N. Jha, Vidyaniidhi Prakashan, Delhi 2016.



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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B. Tech. VII Sem.	IP07TMC02	Indian Constitution	3	-	-	-	-	-	-

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To help the students to understand and explain the fundamental rights.
- To describe the uses of directive principle.
- Importance of union executives.
- Describe the composition of legislative assembly, its powers and functions.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Understand the meaning and importance of constitution.
- Identify and explore the basic features and modalities about Indian constitution.
- Realize the state and central policies (union and state executive), fundamental rights & their duties.
- Analyze the salient (outstanding) features of Indian constitution.
- Recognize the importance and significance of preamble with respect to Indian constitution.

MODULE – I

Introduction: Constitution-meaning of the term, sources and constitutional theory, features, citizenship preamble.

MODULE – II

Fundamental rights and duties: Fundamental rights, fundamental duties, directive principles of state policy.

MODULE – III

Union government: Structure of Indian union: federalism, Centre-state relationship President: role, power and position, Prime minister and council of ministers, cabinet and central secretariat, Lok Sabha, Rajya Sabha.

MODULE – IV

State Government: Governor: role and position, chief minister and council of ministers, state secretariat.

MODULE -V



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Industrial and Production Engineering

Programme Name : M.Tech.

Academic Year : 2021-22

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	IPPATT1	COMPUTER AIDED DESIGN
02.	IPPATT2	FUNDAMENTALS OF ROBOTICS
03.	IPPATP1	COMPUTER INTEGRATED MANUFACTURING
04.	IPPATP2	RAPID PROTOTYPING AND TOOLING
05.	IPPATP3	SUPPLY CHAIN MANAGEMENT
06.	IPPATP4	ADVANCED MANUFACTURING PROCESSES
07.	IPPATP5	MECHANICS OF SHEET METAL FORMING
08.	IPPATP6	MICRO-MANUFACTURING
09.	IPPATP7	MODELING & SIMULATION
10.	IPPATP8	THEORY OF VIBRATION
11.	IPPATP9	ARTIFICIAL INTELLIGENCE
12.	IPPATC1	RESEARCH METHODOLOGY& IPR
13.	IPPALT1	CAD-CAM LAB
14.	IPPBTT1	FINITE ELEMENT ANALYSIS
15.	IPPBTT2	ROBOTICS AND CONTROL
16.	IPPBTP1	GREEN MANUFACTURING
17.	IPPBTP2	ADVANCE OPERATION RESEARCH
18.	IPPBTP3	TOTAL QUALITY MANAGEMENT



19	IPPBTP4	MECHANICS OF COMPOSITE MATERIAL
20	IPPBTP5	SMART MATERIALS AND APPLICATIONS
21	IPPBTP6	MECHATRONICS IN MANUFACTURING SYSTEMS
22	MSPBTO1	BUSINESS ANALYTICS
23	IPPBTO2	INDUSTRIAL SAFETY
24	IPPBTO3	OPERATIONS RESEARCH
25	CEPBTO4	COST MANAGEMENT OF ENGINEERING PROJECTS
26	MEPBTO5	COMPOSITE MATERIALS
27	CHPBTO6	WASTE TO ENERGY
28	ECPBTO7	IOT
29	MCPBTO8	MOOCS
30	ELPBTX1	ENGLISH FOR RESEARCH PAPER WRITING
31	PEPBTX2	STRESS MANAGEMENT BY YOGA
32	CEPBTX3	DISASTER MANAGEMENT
33	LAPBTX4	CONSTITUTION OF INDIA
34	IPPBPT1	MINI PROJECT/SEMINAR
35	IPPBLT1	ROBOTICS LAB
36	IPPCPT1	DISSERTATION STAGE-I
37	IPPDPT1	DISSERTATION STAGE-II

गुरु घासीदास विश्वविद्यालय
(केन्द्रीय विश्वविद्यालय अधिनियम 2009 क्र. 25 के अंतर्गत स्थापित केन्द्रीय विश्वविद्यालय)
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya
(A Central University Established by the Central Universities Act 2009 No. 25 of 2009)
Koni, Bilaspur - 495009 (C.G.)

Scheme and Syllabus

गुरु घासीदास विश्वविद्यालय
(केन्द्रीय विश्वविद्यालय अधिनियम 2009 क्र. 25 के अंतर्गत स्थापित केन्द्रीय विश्वविद्यालय)
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**GURU GHASIDAS VISHWAVIDYALAYA
BILASPUR (C.G.)**

(A Central University)
Koni, Bilaspur-495009, C.G (India)



**OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM (CBCS)**

**MASTER OF TECHNOLOGY
IN
CAD-CAM AND ROBOTICS**

COURSE STRUCTURE AND SYLLABI

**M.Tech. Regular Two Year Degree Program
(Effective from the academic year 2021-22)**

**DEPARTMENT OF INDUSTRIAL & PRODUCTION
ENGINEERING
SCHOOL OF ENGINEERING & TECHNOLOGY, GGV,
BILASPUR, C.G. (INDIA)**



With effect from Academic Year 2021-22

**DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
SCHOOL OF ENGINEERING & TECHNOLOGY, GGV, BILASPUR, C.G. (INDIA)**

SCHEME OF EXAMINATION

M.TECH. CAD-CAM and ROBOTICS

M.Tech. I-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	IPPATT1	Computer Aided Design	3	0	0	40	60	100	3
2.	IPPATT2	Fundamentals of Robotics	3	0	0	40	60	100	3
3.		Elective – I	3	0	0	40	60	100	3
	IPPATP1	1. Computer Integrated Manufacturing							
	IPPATP2	2. Rapid Prototyping and Tooling							
	IPPATP3	3. Supply chain management							
4.		Elective – II	3	0	0	40	60	100	3
	IPPATP4	1. Advanced Manufacturing Processes							
	IPPATP5	2. Mechanics of Sheet Metal Forming							
	IPPATP6	3. Micro-manufacturing							
5.		Elective – III	3	0	0	40	60	100	3
	IPPATP7	1. Modeling & Simulation							
	IPPATP8	2. Theory of Vibration							
	IPPATP9	3. Artificial Intelligence							
6.	IPPATC1	Research Methodology& IPR	2	0	0	-	50	50	2
7.	IPPALT1	CAD-CAM lab	0	0	4	30	20	50	2
Total			17	0	4	230	370	600	19



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M.TECH. CAD-CAM and ROBOTICS

M.Tech. II-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	IPPBTT1	Finite Element Analysis	3	0	0	40	60	100	3
2.	IPPBTT2	Robotics and Control	3	0	0	40	60	100	3
3.		Elective – IV	3	0	0	40	60	100	3
	IPPBTP1 IPPBTP2 IPPBTP3	1. Green Manufacturing 2. Advance Operation Research 3. Total Quality Management							
4.		Elective – V	3	0	0	40	60	100	3
	IPPBTP4 IPPBTP5 IPPBTP6	1. Mechanics of Composite Material 2. Smart Materials and Applications 3. Mechatronics in Manufacturing Systems							
5.		Open Elective	3	0	0	40	60	100	3
	MSPBTO1 IPPBTO2 IPPBTO3 CEPBTO4 MEPBTO5 CHPBTO6 ECPBTO7 MCPBTO8	1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy 7. IoT 8. MOOCs							
6.		Audit Course/Value Added Course	2	0	0	0	0	0	0
	ELPBTX1 PEPBTX2 CEPBTX3 LAPBTX4	English for Research Paper Writing Stress Management by Yoga Disaster Management Constitution of India							
7.	IPPBPT1	Mini Project/Seminar	0	0	4	30	20	50	2
8.	IPPBLT1	Robotics lab	0	0	4	30	20	50	2
Total			17	0	08	260	340	600	19

Note: Under MOOCs the students have to opt any subject other than Industrial & Production Engineering from NPTEL/UGC SWAYAM



With effect from Academic Year 2021-22

M.TECH. CAD-CAM and ROBOTICS

M.Tech. III-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	IPPCPT1	Dissertation Stage-I	0	0	28	100	100	200	14
Total			0	0	28	100	100	200	14

M.TECH. CAD-CAM and ROBOTICS

M.Tech. IV-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	IPPDPT1	Dissertation Stage-II	0	0	32	100	200	300	18
Total			0	0	32	100	200	300	18

Total Credits for the Program = 19 + 19 +14 +18 = 70

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPATT1	Computer Aided Design	3	0	0	40	60	100	3

IPPATT1- COMPUTER AIDED DESIGN

Course Objectives

The objective of this course is to;

1. Get idea of basic fundamentals of computer graphics used in CAD hardware and software and its communications.
2. Introduce various algorithms and mathematical expressions of curves, surface and solid CAD model.
3. Impart knowledge of new design concept and optimization technique to generate surface and solid in CAD.
4. Introduce basic fundamental of finite element method (FEM) for design optimization of mechanical element.

Course Outcomes

After successful completion of this course students are able to;

1. Generate and interpret engineering design of mechanical parts according to engineering design standards and its role in graphic communication process.
2. Impart knowledge of conceptual understanding of the principles of CAD systems, the



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implementation of these principles, and its connections to CAE systems.

3. Comprehend the coordinate representation of 2-D and 3-D entity and formulate the geometric transformations and its projections.
4. Get knowledge of mathematical representations of curves, surface and solid model and analysis of designed object.
5. Analyze the solid model and able to calculate its property through basic fundamental of FEM.

COURSE CONTENTS

Module 1

Introduction and progressive development of CAD, CAD system evaluation criteria, hardware and software, hardware integration and networking, computer communication, color management and raster graphics, aliasing and anti-aliasing, lines, circle and ellipse algorithms, windowing, clipping and view port.

Module 2

Coordinate systems, fundamental of geometric transformations, homogeneous representations, concatenation and composite transformations, 2-D and 3-D geometric transformations, orthographic and oblique projections.

Module 3

Basics of curves, parametric and non-parametric curves, analytical and synthetic curves, parametric representation of analytical and synthetic curves, Hermite curves, curve manipulations, Bèzier curves, B-splines, rational curves, wire frame models.

Module 4

Mathematical representation of surfaces, analytical and synthesis surfaces, parametric representation of surfaces such as; plane surface, tabulated surface, revolve surface, ruled surface, coon's patch, bilinear surface, Hermite bi-cubic surface, Ferguson surface, Bèzier surface patch, B-Spline surface patch, NURBS surface patch.

Module 5

Progressive development and fundamental of solid modeling, solid primitives, primitive instancing (PI), set theories, regularized Booleans set operation (RBSO), constructive solid geometry (CSG), boundary representation (B-rep), sweep representations (SR), spatial occupancy enumeration, cellular and octree decomposition (CD), analytic solid modeling (ASM), introduction to finite element method (FEM), 1-D FEM analysis.

Text Books & References

1. Zeid I. & Subramanian R. S., CAD/CAM Theory and practice, Tata McGraw Hill.



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2. Zeid I., Mastering CAD/CAM, McGraw Hill International.
3. Groover M.P. & Zimmers E., CAD/CAM: Computer-Aided Design and Manufacturing, Pearson Education.
4. Pearson Education.
5. Rao P. N., CAD/CAM Principles and Applications, Tata McGraw Hill.
6. Alavala, CAD/CAM Concepts and Applications, Prentice Hall of India.
7. Krishnamurthy N., Introduction to Computer Graphics, Tata McGraw Hill.
8. Newman W.M. & Sproull R.F., Principles of Interactive Computer Graphics, Tata McGraw Hill.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ES E	Total	
IPPATT2	Fundamentals of Robotics	3	0	0	40	60	100	3

IPPATT2-FUNDAMENTALS OF ROBOTICS

Course Objective

The objective of this course is to;

1. Provide the concept of automation and robots and its challenges in real world environment.
2. Introduce the concept of drives, actuators, sensors and machine vision used in robotics.
3. Impart knowledge of the gripper and control aspects of the robotic systems.
4. Introduce the working principles of intelligent autonomous vehicle (IAV) and quad-rotors unmanned aerial vehicle (QUAV).

Course Outcome

At the end of the course students will be able to;

1. Learn basic concepts associated with automation and robotics and aware of recent updates in robotics.
2. Recognize the application of various drives and actuators used in robotic system.
3. Understand the basic concept of sensors and machine vision system used in robotic system.
4. Acquire knowledge of working principles of grippers and control system used in robotics.
5. Learn concept of intelligent autonomous vehicle (IAV) and quad-rotors unmanned aerial vehicle (QUAV) used in industries and non-industries.

COURSE CONTENTS

Module-1

Automation concept and need, principles and strategies of automation, basic elements of an automated system, levels of automations, advanced automation functions, numeric control machine and robots, robot anatomy and classifications, laws of robotics, accuracy and repeatability, challenges of various robots, typical industrial and non-industrial applications of



With effect from Academic Year 2021-22

robots.

Module -2

Introduction of robot drives and actuators, functions and classification of drive and actuator systems, selection of drives and actuators, pneumatic and hydraulic drives, motors used in robotics, arrangement of actuators in robots, error response, feedback and feed forward compensations, modeling of robot servos, computer controlled servo systems, selection of robot drives and actuators.

Module -3

Introduction to sensors and transducers, characteristics and requirements of sensing devices, classifications and functions of sensors and transducers, various types of sensors, robot guidance with vision system, vision system devices, image acquisition, masking, sampling and quantization, image processing techniques, edge detection, segmentation, calibration of sensors and multisensory-controlled robot.

Module -4

Design aspect of gripper, functions and types of grippers, force analysis for various basic gripper systems, characteristics of control systems, types of controllers, open and closed loop control, robot and industrial control systems, continuous versus discrete control, control system components, motion interpolation, WAIT, SIGNAL and DELAY commands, subroutines, introduction to various types such as RAIL and VAL II etc, features of type and development of languages for recent robot systems.

Module- 5

Introduction of autonomous mobile robots (AMR) and quad-rotors unmanned aerial vehicles (QUAV), holonomic and non-holonomic, sensing and control, navigation algorithms, stability and controllability of intelligent automated vehicles (IAV) and QUAV, driver assistance and monitoring systems, road scene interpretation, need and necessity of IAV and QUAV, industrial and non-industrial applications of IAV and QUAV.

Text Books & References

1. John J. Craig, "Introduction to robotics", Addison Wesley Longman.
2. Nagrath I.J. & Mittal R.K., "Robotics & Control" Tata McGraw Hill.
3. Murphy, "Introduction of AI robotics", MIT press.
4. Siegwart R., Nourbakhsh I.R. & Scaramuzza D., "Introduction to Autonomous Mobile Robots", MIT press.
5. Rogelio Lozano, "Unmanned Aerial Vehicles: Embedded Control", Wiley Publisher.
6. Gareth J., Monkman, Stefan H., Ralf S. & Henrik S., "Robot Grippers", Wiley Publisher.



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Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Elective – I	3	0	0	40	60	100	3
IPPATP1	1. Computer Integrated Manufacturing							
IPPATP2	2. Rapid Prototyping and Tooling							
IPPATP3	3. Additive Manufacturing Technologies							

IPPATP1 COMPUTER INTEGRATED MANUFACTURING

Course Objectives:

The objective of this course is to

1. Emphasize the integration of manufacturing enterprise using computer-integrated manufacturing (CIM) technologies.
2. Employ CAD/CAM interface and other CIM subsystems.
3. Develop database management, facility layout, Group technology, teamwork, and manufacturing operations.

Course Outcomes:

At the end of the course students will be able to

1. Develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.
2. Obtain an overview of computer technologies including computers, database and datacollection, networks, machine control, etc, as they apply to factory management and factory floor operations.
3. Describe the integration of manufacturing activities into a complete system.

COURSE CONTENTS

Module-1

Introduction: Evolution of CIM, scope of CIM, segments of generic CIM, Automated Process Planning- Process planning, group technology, variant and generative process planning methods, AI in process planning, process planning software. CNC technology – Principles of numerical control, features of CNC systems, programming techniques, capabilities of a typical NC CAM software, integration of CNC machines in CIM environment, DNC – Flexible manufacturing systems- Architecture, work stations.

Module-2

Manufacturing Systems: MRP II software, production control software, forecasting, master production schedule, materials requirements planning, capacity requirements planning, shop floor control, shop floor data collection techniques, inventory management, purchase orders, bill of materials, standard product routing, job costing, marketing applications.



With effect from Academic Year 2021-22

Module-3

Robotics, Automated Assembly and Inspection: Types of robots and their performance capabilities, programming of robots, hardware of robots, kinematics of robots, product design for robotized manufacturing, selecting assembly machines, feeding and transfer of parts, applications of robots in manufacture and assembly, sensors. Automated quality control types of CMM, non-contact inspection methods, in process and post process metrology, flexible inspection systems. Computer Aided Inspection and on-line quality monitoring.

Module-4

Data Communications and Technology Management: Technology issues, configuration management, database systems, management of technology, networking concepts, Local area Network (LAN), SQL fundamentals, Manufacturing Automation protocols (MAP) and Technical and office protocols (TOP) fundamentals- CIM models, economics of CIM, implementation of CIM.

Module-5

Collaborative Engineering: Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, supply chain management (SCM), Customer relations management (CRM) Virtual Reality and Factory simulation, Agile and lean manufacturing, reverse engineering, Rapid prototyping.

Text Books & References

1. Manufacturing Engineering and Technology – Serop Kalpak Jain, and Steven R. Smith, Pearson Education.
2. Automation, Production systems and Computer Integrated Manufacturing System – Mikell P. Groover, PHI Publication.
3. Computer Integrated Manufacturing Hand Book – Eric Teicholz and Joel Orr, McGraw Hill Publication.
4. Computer Integrated Manufacturing – Paul G. Ranky, CIMware Publishers.
5. CAD / CAM / CIM – Radhakrishnan, New Age International Publication.

IPPATP2 RAPID PROTOTYPING AND TOOLING

Course Objectives

The objective of this course is to

1. Familiarize the basic concepts of RPT
2. Recognize various process in RP
3. Analyze the principles of Rapid tooling and reverse Engineering.

Course outcome



With effect from Academic Year 2021-22

After completion of the course, the students will be able to:

1. Use different techniques for processing of CAD models for rapid prototyping.
2. Apply fundamentals of rapid prototyping techniques.
3. Use appropriate tooling for rapid prototyping process.
4. Develop different rapid prototyping techniques for reverse engineering.

COURSE CONTENTS

Module 1

Introduction to Prototyping: Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

Module 2

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Module 3

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs. RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

Module 4

Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magic's, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.



With effect from Academic Year 2021-22

Module 5

RP Applications: Application: Material Relationship, Application in Design , Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewellery Industry, Coin Industry, GIS application, Arts and Architecture. **RP Medical and Bioengineering Applications:** Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Bio-molecules.

Text Books & References

1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
2. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.
3. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
4. Hilton P, Jacobs P F, Rapid Tooling: Technologies and Industrial Applications, CRC press.
5. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press.
6. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer.

IPPATP3 SUPPLY CHAIN MANAGEMENT

Course Objectives

The objective of this course is to

1. To define supply chain, its importance and management.
2. To categorize various drivers of Supply Chain for grasping effectual performance
3. To understand about uncertainty, risk management and forecasting.
4. To outline Competitive advantages, Distribution Networks and Supply Chain Strategies
5. To elaborate drivers and barriers of Distribution Networks in Practice.

Course Outcomes

After the completion of this course, students will be:

1. Demonstrate a basic understanding about Competition and Supply Chain Strategies
2. Acquire knowledge about distribution network, E-Business and Time-Series
3. Demonstrate technical understanding about demand, inventory, safety, pricing.
4. Implement decision making policies, infrastructure and optimum Design for handling Transportation Network.
5. Resolve uncertain and risk decision in decision making and can capably tailored



With effect from Academic Year 2021-22

transportation and supply chain costs.

COURSE CONTENTS

Module 1

Building a Strategic Framework to Analyze Supply Chains: What Is a Supply Chain? The Objective of a Supply Chain, The Importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of a Supply Chain, Examples of Supply Chains, Supply Chain Performance: Achieving Strategic Fit and Scope, Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope, Supply Chain Drivers and Metrics, Drivers of Supply Chain Performance, framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing.

Module 2

Designing the Supply Chain Network: Designing Distribution Networks and Applications to e-Business the Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network, e-Business and the Distribution Network, Distribution Networks in Practice.

Network Design in the Supply Chain: The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation, The role of IT in Network Design, Making Network Design Decisions in Practice.

Network Design in an Uncertain Environment: The Impact of Uncertainty on Network Design, Discounted Cash Flow Analysis, Representations of Uncertainty, Evaluating Network Design Decisions Using Decision Trees, AM Tires: Evaluation of Supply, Chain Design Decisions Under Uncertainty, Risk Management and Network Design, Making Supply Chain Decisions Under Uncertainty in Practice

Module 3

Planning Demand and Supply in a Supply Chain: Demand Forecasting in a Supply Chain, The Role of Forecasting in a Supply Chain, Characteristics of Forecasts, Components of a Forecast and Forecasting Methods, Basic Approach to Demand Forecasting, Time-Series Forecasting Methods, Measures of Forecast Error, Forecasting Demand at Tahoe Salt, The Role of IT in Forecasting, Risk Management in Forecasting, and Forecasting in Practice.

Aggregate Planning in a Supply Chain: The Role of Aggregate Planning in a Supply Chain, the Aggregate Planning Problem, Aggregate Planning Strategies, Aggregate Planning Using Linear Programming, Aggregate Planning in Excel. The Role of IT in Aggregate Planning, Implementing Aggregate Planning in Practice.

Planning Supply and Demand in a Supply Chain: Managing Predictable Variability, Responding to Predictable Variability in a Supply Chain, Managing Supply, Managing Demand, Implementing Solutions to Predictable Variability in Practice.

Module 4

Planning and Managing Inventories in a Supply Chain: Managing Economies of Scale in a Supply Chain, Cycle Inventory, The Role of Cycle Inventory in a Supply Chain, Economies of Scale to Exploit Fixed Costs, Economies of Scale to Exploit Quantity Discounts, Short-Term Discounting:



With effect from Academic Year 2021-22

Trade Promotions, Managing Multiechelon Cycle Inventory, Estimating Cycle Inventory-Related Costs in Practice.

Managing Uncertainty in a Supply Chain: Safety Inventory, The Role of Safety Inventory in a Supply Chain, Determining Appropriate Level of Safety Inventory, Impact of Supply Uncertainty on Safety Inventory, Impact of Aggregation on Safety Inventory, Impact of Replenishment Policies on Safety Inventory, Managing Safety, Inventory in a Multiechelon Supply Chain, The Role of IT in Inventory Management, Estimating and Managing Safety Inventory in Practice.

Determining the Optimal Level of Product Availability: The Importance of the Level of Product Availability, Factors Affecting Optimal Level of Product Availability, Managerial Levers to Improve Supply Chain Profitability, Setting Product Availability for Multiple Products under Capacity Constraints, Setting Optimal Levels of Product Availability in Practice

Module 5

Designing and Planning Transportation Networks: Transportation in a Supply Chain, The Role of Transportation in a Supply Chain, Modes of Transportation and Their Performance Characteristics, Transportation Infrastructure and Policies, Design Options for a Transportation Network Trade-Offs in Transportation Design, Tailored Transportation, The Role of IT in Transportation Risk Management in Transportation, Making Transportation Decisions in Practice.

Managing Cross-Functional Drivers in a Supply Chain: Sourcing Decisions in a Supply Chain, the Role of Sourcing in a Supply Chain, In-House or Outsource, Third- and Fourth-Party Logistics Providers, Supplier Scoring and Assessment, Supplier Selection-Auctions and Negotiations Contracts and Supply Chain Performance, Design Collaboration, The Procurement Process, Sourcing Planning and Analysis, The Role of IT in Sourcing, Risk Management in Sourcing, Making Sourcing Decisions in Practice.

Text Books:

1. Supply Chain Management: Janat Shah, Pearson Publications 2010.
2. Supply Chain Management: Sunil Chopra and Mein del, Fourth Edition, PHI 2010.
3. Supply Chain Management: A.S.Altekar PHI Second Ed.2006.
4. Logistics Management: James Stock and Douglas Lambert. McGraw Hill International Ed.2006.
5. Supply Chain Management for Global Competitiveness :Ed.B.S.Sahay McMillanPublication 2000
6. Emerging Trends in Supply Chain Management: Ed.B.S.Sahay McMillan Publication2000.
7. Logistics Management: Bowersox TMH 2004.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Elective – II	3	0	0	40	60	100	3
IPPATP4	4. Advanced Manufacturing Processes							
IPPATP5	5. Mechanics of Sheet Metal Forming							
IPPATP6	6. Micro-manufacturing							



With effect from Academic Year 2021-22

IPPATP4 Advanced Manufacturing Processes

Course Objectives:

The objective of this course is to

1. Provide the in depth knowledge of the types of advanced manufacturing and machining processes (AMPs); evolution, and need.
2. Acquire fundamental knowledge and understanding of Production and Industrial Engineering and to know about the applications of advanced manufacturing processes
3. Make acquainted the various unconventional manufacturing processes
4. Create a congenial environment that promotes learning, growth and imparts ability to work with multi-disciplinary groups in professional, industry and research organizations
5. Encourage the students for developing the models of Advanced Manufacturing Processes

Course Outcomes:

On completion of this course, the students will be able to

1. Categorize different material removal, joining processes as per the requirements of material being used to manufacture end product.
2. Select material processing technique with the aim of cost reduction, reducing material wastage & machining time.
3. Identify the correct advanced manufacturing processes by formulating and determining the correct AMPs for development of various complex shaped geometries
4. Interpret foundry practices like pattern making, mold making, Core making and Inspection of defects.
5. Classify different plastic molding processes, Extrusion of Plastic and Thermoforming.
6. Select appropriate Joining Processes to manufacture any component.

COURSE CONTENTS

Module 1

Advanced foundry processes - metal mould, continuous, squeeze, vacuum mould, evaporative pattern, and ceramic shell casting.

Module 2

Non-Traditional Machining: Introduction, need, AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment, process characteristics, performance, EDM – principles, equipment, generators, analysis of R-C circuits, MRR, Surface finish, WEDM.

Module 3

Laser Beam Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electron Beam Machining - Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electro Chemical Machining – Principle of working, equipment, Material removal rate, Process



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parameters, performance characterization, Applications.

Module 4

Advanced forming processes - electro-magnetic forming, explosive forming, electro-hydraulic forming, stretch forming, contour roll forming

Module 5

Advanced welding processes - EBW, LBW, USW

Text Books and References:

1. Manufacturing Engineering and Technology by Kalpak Jain, Addison Wesley, 1995.
2. Materials and Processes in Manufacturing (8th Edition), E.P. DeGarmo, J. T Black, R.A.Kohser, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
3. Advanced Machining Processes by V. K. Jain, Allied Publications.
4. Manufacturing Science, A. Ghosh, and A.K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi
5. Nontraditional Manufacturing Processes, G.F.Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7).
6. Introduction to Manufacturing Processes by John A Schey, Mc Graw Hill.
7. Non-Traditional Manufacturing Processes by Gary F Benedict, CRC Press.
8. Advanced Methods of Machining by J. A Mc Geough, Springer

IPPATP5 MECHANICS OF SHEET METAL FORMING

Course Objectives:

The objective of this course is to

1. Develop various metal forming processes
2. Generate the concept of plastic deformation during forming processes
3. Different laws and equations developed for solving metal forming problems

Course outcomes:

After completion of this course, the student should be able to:

1. Generate the concept of different metal forming process.
2. Approach metal forming processes both analytically and numerically
3. Design metal forming processes
4. Develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.

COURSE CONTENTS

Module 1

Classification of forming processes mechanism of metal forming, temperature of metal working, hot working, cold working, friction and lubricants. Rolling of metals: Rolling processes, forces and



With effect from Academic Year 2021-22

geometrical relationship in rolling, simplified analysis, rolling load, rolling variables, theories of cold and hot rolling, problems and defects in rolling, torque and power calculations.

Module 2

Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging. Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, and production of seamless pipes.

Module 3

Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing. Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, and defect in formed parts.

Module 4

HERF, Electromagnetic forming, residual stresses, in-process heat treatment, computer applications in metal forming. Press tool design: Design of various press tools and dies like piercing dies, blanking dies, compound dies and progressive blanking dies, design of bending, forming and drawing dies.

Module 5

Forming methods dies & punches, progressive die, compound die, combination die, Rubber forming, Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring. Simple problems

Text Books and References:

1. Mechanical Metallurgy / G.E. Dieter / Tata McGraw Hill, 1998. III Edition
2. Principles of Metal Working / Sunder Kumar
3. Principles of Metal Working processes / G.W. Rowe
4. ASM Metal Forming Hand book
5. Mechanical metallurgy (SI Units), G.E.Dieter, McGraw hill Pub-2001.
6. Manufacturing Science, Amithab Gosh &A.K.Malik, East-West press 2001.

IPPATP6 MICRO-MANUFACTURING

Course Objectives:

The objective of this course is to

1. To introduce the principles fundamental and process mechanics of micromachining
2. To understand of mechanics at micro level machining.
3. To analyze on the mechanical/chemical behavior changes during micromachining/manufacturing.
4. To evaluate micro and macro machining, visualize micro machining process.



With effect from Academic Year 2021-22

5. To understand application and advancements in the micro machining process.

Course Outcomes:

On completion of this course, the students will be able to

1. Acquire knowledge about different micro-machining processes.
2. Acquire knowledge about super finishing processes.
3. Understand about the capabilities of different micro-manufacturing processes.
4. Understand about the capabilities of different advanced micro-manufacturing processes.
5. Understand about the capabilities of traditional micro-manufacturing processes.

COURSE CONTENTS

Module 1

Introduction and classification of micromachining, Mechanical type micro machining processes: Abrasive jet micromachining (AJMM), Ultrasonic micromachining, abrasive water jet micro machining (AWJMM)

Module 2

Magneto-rheological finishing (MRF), Magneto-rheological abrasive flow finishing (MRAFF), Magnetic float polishing (MFP).

Module 3

Chemical and electrochemical type advanced machining processes, Electrochemical micromachining (EDMM), electrochemical micro deburring, Chemical and photochemical micromachining. Abrasive based nano finishing processes, Abrasive flow finishing (AFF), Chemo-mechanical polishing (CMP), Magnetic abrasive finishing (MAF)

Module 4

Thermo electric type micro-machining process, Electric discharge micromachining (EDMM), wire EDM, EDDG, ELID, Laser beam micro machining (LBMM), Electron beam micromachining (EBMM)

Module 5

Traditional mechanical micro-machining processes, Micro turning, micro milling, micro drilling.

Text Books & References

1. Introduction to micromachining, VK Jain, Narosa Publisher, New Delhi 2nd edition.
2. Micromachining methods, JA Mc Geough, Champan and Hall, London.
3. Micro manufacturing processes, VK Jain CRC Press.
4. Advanced machining processes, VK Jain, Allied Publisher New Delhi.



With effect from Academic Year 2021-22

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Elective – III	3	0	0	40	60	100	3
IPPATP7	6. Modeling & Simulation							
IPPATP8	7. Theory of Vibration							
IPPATP9	8. Artificial Intelligence							

IPPATP7 MODELING & SIMULATION

Course Objectives:

The objective of this course is to

1. Design the importance of modeling to science and engineering.
2. Describe future trends and issues in science and engineering, and identify specific industry related examples of modeling in science and engineering.
3. Utilize the modeling Process to identify the key parameters of a model, estimate model outcomes, utilize a computational tool, e.g. MATLAB to implement the mathematical representation of the model, convey the results of the simulation accurately, validate the model with data, and discuss the quality and sources of errors in the model.
4. Conduct the transforming of continuous functions and dynamics equations into discrete computer representations.
5. Examine mathematical representations of functions - Describe and utilize linear and nonlinear functions to model empirical data. Visualize empirical data and the fitting function using a computational tool.

Course Outcomes:

On completion of this course, the students will be able to

1. Develop the techniques of modeling in the context of hierarchy of knowledge about a system and develop the capability to apply the same to study systems through available software.
2. Analyze different types of simulation techniques.
3. Simulate the models for the purpose of optimum control by using software.
4. Identify different types of models and simulations, describe the iterative development process of a model, and
5. Explain the use of models and simulations for hypothesis testing and explain how models link the physical world, the virtual world and the science of prediction.

COURSE CONTENTS

Module 1

Introduction: Definition and components of a system, continuous and discrete systems. Modelling: Concepts of system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models. Simulation: Basics of simulation, Steps in simulation, Discrete event



With effect from Academic Year 2021-22

system simulation, Advantages and disadvantages of simulation, Decision making with simulation.

Module 2

Statistical Models: Review of terminology and concepts, Useful statistical models, Discrete distributions, Continuous distributions, Poisson process, Empirical distributions, Random numbers, Techniques for random generation. Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems, Application of models.

Module 3

System Simulation: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Distributed lag models, Cobweb models Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies.

Module 4:

Simulation software: Comparison of simulation packages with programming languages, classification of simulation software, Description of a general purpose simulation package, Design of scenario and modules, dialog box, database, animation, plots and output, interfacing with other software, summary of results. Examples with MATLAB/ AWESIM / ARENA.

Module 5

Analysis after simulation: Importance of the variance of the sample mean, Procedure for estimating mean and variance, Subinterval method, Replication Method, Regenerative method; Variance reduction techniques, Start up policies, Stopping rules, Statistical inferences, Design of experiments. Verification and validation of simulated models, optimization via simulation. Case studies on application of modeling and simulation in manufacturing systems.

Text books & References:

1. Averill M. Shaw, "Simulation Modeling and Analysis", Tata McGraw-Hill, 2007.
2. Frank L. Severance, "System Modeling & Simulation-an Introduction", John Wiley & Sons, 2001.
3. Geoffrey Gordon, "System Simulation", Prentice Hall India, 1969.
4. Robert E. Shannon, "System Simulation: The Art and Science", Prentice Hall India, 1975.
5. Charles M Close and Dean K. Frederick Houghton Mifflin, "Modelling and Analysis of Dynamic Systems: TMH, 1993.
6. Allan Carrie, "Simulation of manufacturing", John Wiley & Sons, 1988

IPPATP8 THEORY OF VIBRATION

Course Objectives:

The objective of this course is to

1. Formulate mathematical models of problems in vibrations using Newton's second law or energy principles,
2. Determine a complete solution to the modeled mechanical vibration problems.



With effect from Academic Year 2021-22

3. Correlate results from the mathematical model to physical characteristics of the actual system.
4. To be able to mathematically model real-world mechanical vibration problems

Course Outcomes:

On completion of this course, the students will be able to

1. Determine the natural frequency of transverse vibrations of the shaft and torsional vibrations of rotor systems.
2. Analyze the mathematical modelling of the two degrees of freedom systems and explain about the working principle of vibration absorber.
3. Compute the natural frequencies and mode shapes of a multi degree of freedom system and explain the modal analysis of a vibrating system.
4. Select the numerical methods to determine natural frequencies of the beam and rotor systems.
5. Describe the vibration measurement by using transducers and vibration exciters.

COURSE CONTENTS

Module 1

Element of vibration system: - lumped mass, stiffness and damping, simple harmonic motion, vector representation. Single degree of freedom system, equation of motion-energy method, Newton law based, general solution, free and forced vibration, damped and undamped motion.

Module 2

Damped Vibration, equivalent damping, logarithmic decrement, damping measurement, forced vibration, rotating and reciprocating unbalance, vibration, absorber, Seismic instruments

Module 3

Transient vibration: - impulse response, Convolution integral, Fourier analysis.

Module 4

Multi degree freedom system, equation of motion, co-ordinate coupling, undamped forced vibration, principal modes, generalized co-ordinates, semi-definite system, orthogonality of modes, modal analysis, Lagrange's equation.

Natural frequency numerical solution: - Rayleigh's method, Dunkerley's method, Holzer method,

Transfer matrix, Iteration method.

Module 5

Continuous system: Vibration of stretched cord, torsional vibration, longitudinal vibration of slender rod, lateral vibration of beams, Shear deformation and rotary inertia effect, Rayleigh's quotient, Rayleigh's-Ritz method.

Text Books & References

1. Tse, S. Morse, R. Rolland, T. Hinkle, Ivan E. "Mechanical vibrations theory and Application" Published by Allyn and Bacon.
2. Thomson T. Milliam "Theory of vibrations with applications" Prentice Hall of India.



With effect from Academic Year 2021-22

3. HartogDen, J.P. "Mechanical vibrations" Tata McGrawHills, 4th edition 1956)
4. Meirovitch L. "Elementsofvibrationanalysis McGrawHills-1956
5. Anderson R. A. "Fundamentals of vibration" Mecmillanpress 1967
6. Kbstad N.O. "Fundamentals of vibration analysis" McGrawHills-1956
7. Robert K. Vicrck "Vibration analysis" Published by Harper & Row
8. Timoshenko S., Young D.H. & Ileavev W. Jr. "Vibration problem in engineering 4th ed, New York Willey 1974
9. Merovitch, L., "Analytical methods in vibration" published by Macmillan (1967)

IPPATP9 ARTIFICIAL INTELLIGENCE

Course Objectives:

The objective of this course is to

1. To impart knowledge about Artificial Intelligence.
2. To give understanding of the main abstractions and reasoning for intelligent systems.
3. To enable the students to understand the basic principles of Artificial intelligence in various applications.

Course Outcomes:

On successful completion of this course, students will be able:

1. Solve basic AI based problems.
2. Define the concept of Artificial Intelligence.
3. Apply AI techniques to real-world problems to develop intelligent systems.
4. Select appropriately from a range of techniques when implementing intelligent systems.

COURSE CONTENTS

Module-1

Introduction to artificial intelligence and intelligent agents, categorization of AI, Production systems and rules for some AI problems: water jug problem, missionaries-cannibals problem etc. Solving problems by searching: state space formulation, depth first and breadth first search, iterative deepening.

Module-2

Intelligent search methods, memory restricted variants Heuristic search: Hill climbing, best-first search, problem reduction, constraint satisfaction. Game Playing: Minimax, alpha-beta pruning.

Module-3

Knowledge and reasoning: Propositional and first order logic, semantic networks, building a knowledge base, inference in first order logic, logical reasoning systems Planning: Components of a planning system, goal stack planning, non-linear planning strategies, probabilistic reasoning systems, Bayesian networks.



With effect from Academic Year 2021-22

Module-4

Learning: Overview of different forms of learning, Inductive learning, learning decision trees, computational learning theory, Artificial neural networks. Evolutionary computation: Genetic algorithms, swarm intelligence, particle swarm optimization.

Module-5

Applications: Robotics, Natural language processing etc.

Text & Reference Books

1. Rich and Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2014.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, 2011.
3. Deepak Khemani, "A First Course in Artificial Intelligence", Tata McGraw Hill, 2013.
4. S. Russel and P. Norvig, "AI: A modern approach", 3rd Edition, Pearson Education, 2009.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPATC1	Research Methodology & IPR	2	0	0	-	50	50	2

IPPATC1 RESEARCH METHODOLOGY & IPR

Course Objectives

The objective of this course is to

1. To familiarize participants with basic of research and the research process.
2. To enable the participants with basic understanding of types of data and data collection methods.
3. To enable the participants in conducting research work and formulating research synopsis and report.
4. To familiarize participants with IPR.
5. To impart knowledge for enabling students to develop data analytics skills and meaningful interpretation to the data sets so as to solve the research problem.

Course Outcomes:

On successful completion of this course, students will be able:

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property
5. Right to be promoted among students in general & engineering in particular.

COURSE CONTENTS

Module 1

Introduction and Design of research: Meaning, objectives and significance of research, types and parameters of research, research process, identification and definition of the research problem,



With effect from Academic Year 2021-22

definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative vs. quantitative research methodology, field studies, field experiments vs. laboratory experiments, research design in social and physical sciences.

Module 2

Data and Methods of Data Collection: Survey, assessment and analysis: data collection, primary and secondary sources of data, Collection of primary data through questionnaire and schedules. Collection of secondary data, processing and analysis of data. Sample survey, simple random sampling, stratified random sampling, systematic sampling, cluster sampling, area sampling and multistage sampling. Pilot survey, scaling techniques, validity & reliability.

Module 3

Data Analysis: Procedure for testing of hypothesis, the null hypothesis, determining levels of significance, type i and ii errors, grouped data distribution, measures of central tendency, measures of spread/dispersion, normal distribution, analysis of variance: one way, two way, chi square test and its application, students 'T' distribution, non-parametric statistical techniques, binomial test. Correlation and regression analysis – discriminate analysis – factor analysis – cluster analysis, measures of relationship

Module 4

Research report preparation and presentation: Review of literature: historical survey and its necessity, layout of research plan, meaning, techniques and precautions of interpretation, types of report: technical report, popular report, report writing – layout of research report, mechanics of writing a research report. Writing bibliography and references.

Module 5

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

Reference Books:

1. Research in education, By J W Best and J V Kahn, Pearson/ Allyn and Bacon.
2. Research Methodology – Methods and Techniques, C K Kothari, New Age International.
3. Design and Analysis of Experiments, D C Montgomery, Wiley.
4. Applied Statistics & Probability for Engineers, D C Montgomery & G C Runger, Wiley.
5. Management Research Methodology: Integration of Principles, Methods and Techniques, K N Krishnaswamy, A I Sivakumar and M Mathiranjani, Pearson Education.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPALT1	CAD-CAM lab	0	0	4	30	20	50	2

IPPALT1 CAD-CAM LAB

Course Objectives:

The objective of this course is to

1. Interpret drawings of machine components
2. Prepare assembly drawings both manually and using standard CAD packages



With effect from Academic Year 2021-22

3. Familiarize the students with Indian Standards on drawing practices and standard components
4. Gain practical experience in handling 2D drafting and 3D modeling software systems
5. Analyze the features of CNC Machine Tool.
6. Expose students to modern control systems (Fanuc, Siemens etc..)
7. Give exposure to software tools needed to analyze engineering problems.
8. Give exposure of different applications of simulation and analysis tools.

Course Outcomes

On successful completion of this course, students will be able:

1. Execute steps required for modeling 3D objects by using protrusion, cut, sweep, extrude commands
2. Convert 3D solid models into 2D drawing-different views, sections
3. Use isometric views and dimensioning of part models
4. Machine simple components on CNC machines
5. Use CAM software to generate NC code

List of Experiments

1. Use of commands of any computer aided drafting software package such as AutoCAD, Pro-engineer, CATIA etc.
2. Development of menu driven software for graphics using output primitives and for clipping of graphical entities.
3. Design of mechanical parts using geometric transformations such as translation, scaling, rotation, reflection etc.
4. Development of software for design of any mechanical element and system.
5. Development of software for analysis of one-dimensional element using FEM technique.
6. Development of computer program for analysis of mechanical element using FEM for user input values.



With effect from Academic Year 2021-22

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBTT1	Finite Element Analysis	3	0	0	40	60	100	3
IPPBTT1 FINITE ELEMENT ANALYSIS								
Course Objectives								
The objective of this course is to;								
<ol style="list-style-type: none"> 1. Implement the basic concept of Finite Element Analysis (FEA) in structural mechanics. 2. Solve 1 D, 2 D and dynamic problems using Finite Element Analysis approach. 3. Formulate the design and heat transfer problems with application of FEM. 								
Course Outcomes								
On successful completion of this course, students will be able:								
<ol style="list-style-type: none"> 1. Implement numerical methods to solve mechanics of solids problems. 2. Formulate and Solve axially loaded bar Problems. 3. Formulate and analyze truss and beam problems. 4. Implement the formulation techniques to solve two-dimensional problems using triangle and quadrilateral elements. 5. Formulate and solve Axi-symmetric and heat transfer problems. 								
COURSE CONTENTS								
Module 1								
Progressive development of FEA, nodes and elements, coordinate systems, application to the continuum, discretization of the domain, element shape, node, nodal element and coordinate system, shape functions, degrading technique, governing equations for continuum, pre-processor, processor and post processor.								
Module 2								
Strain displacement and elemental stiffness matrix, assembling of stiffness equation, boundary conditions and solution, direct approach, Galerkin's and virtual work method, discretisation of structure, analysis of spring, bar and trusses elements.								
Module 3								
Solution of plane stress and plane strain problems, iso-parametric formulations, analysis of beams and rigid frames, bending of thin plates, analysis of shells.								
Module 4								



With effect from Academic Year 2021-22

Navier Solutions of Cross-Ply and angle-ply laminated simply-supported plates, determination of stresses finite element solutions for bending of rectangular laminated plates using CLPT and FSDT, formation of stiffness matrix, formation of load vector, numerical integration, post computation of stresses.

Module 5

Nonlinear Analysis, analysis of material and geometric nonlinear problems, adaptive finite analysis, automatic mesh generation, choice of new mesh, transfers variables.

Text & Reference Books

1. Rao S.S., "The Finite Element Method in Engineering", Elsevier Science & Technology.
2. Hutton D.V., "Fundamental of Finite Element Analysis", Mc Graw Hills.
3. Cook R.D., Malkus, D.S. and Plesha, M.E., "Concepts and Applications of Finite Element Analysis", 3rd Ed., John Wiley & Sons.
4. Bathe K.J., "Finite Element Procedures", Prentice Hall of India, New Delhi.
5. Huebner K.H. and Thorton, E.A., "The Finite Element Methods for Engineers" John Wiley & Sons.
6. Zienewicz O.C. and Taylor, R.L., "The Finite Element Methods", Vol.1, Vol.2 and Vol.3, Mc Graw Hill.
7. Belytshko, T., Liu, W.K. and Moran, B., "Non-linear Finite Elements for Continua and Structures", Mc Graw Hills.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBTT2	Robotics and Control	3	0	0	40	60	100	3

IPPBTT2 ROBOTICS AND CONTROL

Course Objective

The objective of this course is to;

1. Study about mechanism, mechanics and mechanical behavior of the industrial robot.
2. Introduce the basic concept of arithmetic formulations and its analysis of the industrial robot.
3. Impart knowledge of kinematic, dynamic and trajectory behavior of the industrial robot.
4. Introduce the concept of controller design and the artificial intelligence used in the robotics.

Course Outcomes

On successful completion of this course, students will be able to;

1. Learn the basic concept of arithmetic modeling of industrial robots.
2. Analysis the forward and inverse kinematic behavior of industrial robots.



With effect from Academic Year 2021-22

3. Understand the dynamic behaviors and trajectory generations of industrial robots.
4. Apply the concept of robot control theory and its application in robot controller.
5. Explore the concept of artificial intelligence and machine learning algorithms used in robotics.

COURSE CONTENTS

Module 1

Progressive development of robotics, man vs machine, specifications and classifications of industrial robot, robot specifications, links joints and terminology, mobility and degree of freedom, yaw, pitch and roll motion, equivalent angle, work envelop geometries, reach and stroke, repeatability, accuracy and precision, the mechanics and control of mechanical manipulator, operating environment, industrial applications.

Module 2

Spatial descriptions and transformations, coordinates frames matrices and their arithmetic, frame assignment to links, fundamental of rotation and translation, homogeneous coordinate frame, composite, inverse and skew homogenous transformation, description of position and orientation, Denavit-Hartenberg (D-H) parameters, arm equations, direct kinematic problems of industrial robots, inverse kinematics, algebraic and geometrical methods, inverse kinematic of roll pitch yaw joints, inverse kinematic problems of industrial robots, multiple solutions.

Module 3

Introduction to dynamics force, inertia and energy, principle of inertia tensor, joint velocity of manipulator, kinetic and potential energy of manipulator, Langrange-Euler formulation, equation of motion, dynamics problems of industrial robots, general description of path planning and trajectory generation, description of cartesian and joint space, manipulator Jacobians and velocity of manipulator, trajectory generation and obstacles avoidance of industrial robot.

Module 4

Introduction and system modeling of manipulator control theory, open loop and close loop control, first order and second order linear system, properties of the dynamic model, linear and nonlinear control techniques, performance and stability of feedback control, Proportional-Derivative (PD) control, Proportional-Derivative-Integral (PID) control, introduction of nonlinear control, multivariable robot control, computed torque control, adaptive control, hybrid control, manipulator interaction with environment, system stability and optimal control, applications and examples.

Module 5

Generation of robot programming languages and software packages, introduction to artificial intelligence, knowledge and reasoning, artificial neural network (ANN) and its applications in robotics, fuzzy logic theories and its applications in robotics. AI based techniques for navigation,



With effect from Academic Year 2021-22

bio inspired algorithms, multiple robot coordination, design and application of intelligent controller.

Text Books & References

1. Fu K.S., Gonzalez R.C. and Lee C.S.G. "Robotics", McGraw Hill Education India.
2. John J. Craig, "Introduction to robotics", Addison Wesley Longman.
3. Schilling Robert J., "Fundamentals of Robotics", Prentice Hall of India.
4. Nagrath I.J. & Mittal R.K., "Robotics & Control" Tata McGraw Hill.
5. Murphy, "Introduction of AI robotics", MIT press.
6. Haykin S., "Neural Networks and Learning Machines", Pearson Publisher.
7. Yen J. & Langari R., "Fuzzy Logic: Intelligence, Control, and Information", Pearson Publisher.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Elective – IV	3	0	0	40	60	100	3
IPPBTP1	1. Green Manufacturing							
IPPBTP2	2. Advance Operation Research							
IPPBTP3	3. Total Quality Management							

IPPBTP1 GREEN MANUFACTURING

Course Objectives:

The objective of this course is

1. The graduates use their talent, self-confidence, knowledge and manufacturing practice which facilitate them to presume position of scientific and/or managerial leadership in their career paths towards green manufacturing.
2. Understand the three pillars of sustainability and how they are manifested in sustainable and green manufacturing.
3. Understand the basics of the green manufacturing concepts, strategy, different technology used to implement green manufacturing.
4. To create congenial environment that promotes learning, growth and imparts ability to work with inter- disciplinary groups in professional, industry and research organizations.
5. Understand Life Cycle Assessment approach to evaluate environmental impacts of product design, manufacturing processes, product use-phase, and product end-of-life.
6. To broaden and deepen their capabilities in analytical and experimental research methods, analysis of data, and drawing relevant conclusions for scholarly writing and presentation.
7. To provide guidance to students for their choices in research and professional career outlook and to encourage students to take up research.

Course Outcomes:

On successful completion of this course, students will be able:



With effect from Academic Year 2021-22

1. Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
2. Graduate will become familiar with green manufacturing concepts and practices and analyze the problems within the domains of Green Manufacturing as the members of multidisciplinary teams.
3. Graduate will be trained towards developing and understanding the impact of environmental oriented components on global, economic, and societal context.
4. Explain the concept and principles of green manufacturing.
5. Plan good housekeeping practices for Industry/other places with concern of safety, hygiene and waste reduction.

COURSE CONTENTS

Module 1

Introduction: Sustainable development, indicators of sustainability, sustainability strategies, sustainable manufacturing, evolution of sustainable manufacturing, elements of sustainable manufacturing, theory of green manufacturing and its principles, need for green manufacturing, drivers and barriers of green manufacturing.

Module 2

Green manufacturing strategy: Manufacturing strategy, elements of manufacturing strategy, manufacturing outputs, competitive priorities: quality, delivery speed and reliability, cost efficiency, flexibility, order winners and order qualifier, tradeoff, production systems, manufacturing levers, competitive analysis, level of manufacturing capability, framework for formulating manufacturing strategy, implications of green manufacturing for manufacturing strategy.

Module 3

Life cycle approach of green manufacturing: Holistic and total Life-cycle approach, six step methodologies for green manufacturing (6-R approach), life cycle assessment (LCA), elements of LCA – Life Cycle Costing, Eco Labeling target setting, data collection and processing, final evaluation by virtue of criteria, environmental management systems.

Module 4

Green manufacturing technology: Definition of green manufacturing technology and practices, classifications of green manufacturing technology, advantages and disadvantages of implementation of green technology.

Module 5

Lean and Green manufacturing: Introduction, lean evolution & steps, introduction to lean manufacturing, definition of lean manufacturing, lean vs. green manufacturing: similarities and differences.



With effect from Academic Year 2021-22

Text Books & References

1. Cleaner Production: Environmental and Economic Perspectives, Misra Krishna B., Springer, Berlin, Latest edition.
2. Environmental Management Systems and Cleaner Production, Dr. Ruth Hillary, Wiley, New York, Latest edition.
3. Pollution Prevention: Fundamentals and Practice, Paul L Bishop, TMH.
4. Costing the earth, Cairncross and Francis, Harvard Business School Press – 2009.
5. The principle of sustainability, Simon Dresner, –Earth Scan publishers (2008).
6. Manufacturing strategy: How to formulate and implement a winning plan, Jhon Miltenburg, Productivity Press Portland, Oregon-2017.
7. Manufacturing strategy, Voss C. A, Chapman & Hall-1992
8. Manufacturing the future, Steve Brown, Prentice Hall, 2000
9. Manufacturing strategy, Terry Hill, Homewood, IL- 1989
10. Becoming Lean - Inside Stories of U.S. Manufacturers, Jeffrey K. Liker, Productivity Press, Portland, Oregon
11. G. Atkinson, S. Dietz, E. Neumayer, — “Handbook of Sustainable Manufacturing”. Edward Elgar Publishing Limited, 2007.
12. D. Rodick, “Industrial Development for the 21st Century: Sustainable Development Perspectives”, UN New York, 2007.
13. Rogers, P.P., Jalal, K.F. and Boyd, J.A., “An Introduction to Sustainable Development”, Earth scan, London, 2007.
14. P. Lawn, “Sustainable Development Indicators in Ecological Economics”, Edward Elgar Publishing Limited.
15. S. Asefa, “The Economics of Sustainable Development”, W.E. Upjohn Institute for Employment Research, 2005

IPPBTP2 ADVANCE OPERATION RESEARCH

Course Objectives:

The objective of this course is

1. To explain the ideas about board education in the techniques and modeling concepts used to analyze and design complex systems.
2. To compile the basic concepts of LPP and various solving techniques.
3. To make use of assignment, transportation, inventory and various other techniques.
4. To illustrate the connection between basics as well the advance tools of the subject to demonstrate the link between theory and its real world.
5. To define of single and multi variable optimization methods with and without constraints



With effect from Academic Year 2021-22

Course Outcomes

On successful completion of this course, Students will be able to-

1. Recall and comprehend the LPP and its formulation with solving techniques.
2. Remember, understand and analyze the analytical solution of Simplex method, Assignment problem, Transportation problem and related topics questions with effective manner.
3. Understanding to apply basics as well the advance tools of the subject to demonstrate the link between theory and its real world applications.
4. Explain the overview of historical development and review of optimization techniques.

COURSE CONTENTS

Module 1

Introduction, Mathematical formulation of the problem, Graphical Solution methods, Mathematical solution of linear programming problem, Slack and Surplus variables. Matrix formulation of general linear programming Problem,

Module 2

The Simplex Method: Artificial variables, two phases Simplex Method, infeasible and unbounded LPP's, alternate optima, Dual problem and duality theorems, dual simplex method and its application in post optimality analysis, Revised Simplex method.

Module 3

Construction and solution of these Models, Hungarian method of solving assignment problem, unbalanced assignment problem, matrix form of transportation problem, Initial basic feasible solution, Balanced and unbalanced transportation problems, u-v method for solving transportation problems Selecting the entering variables, Selecting the leaving variables, Degeneracy in transportation Problem.

Module 4

Introduction and characteristics of dynamic programming, Methods of solution to DP.

Queuing Models, Elementary queuing models, Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.

Module 5

Classical Optimization Techniques, Introduction, Review of single and Multivariable optimization methods with and without constraints

Text Books & References

1. Operation Research, Theory and Application by J.K. Sharma, Macmillan India
2. Quantitative techniques in Management by N. D. Vohra, TMH
3. Operations Research by P.K. Gupta and D.S. Hira, S Chand and Sons
4. Operation Research: An Introduction by H.A. Taha
5. S. S. Rao, Optimization Techniques, Wiley Eastern



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6. Operations Research, Kanti Swarup, S Chand

IPPBTP3 TOTAL QUALITY MANAGEMENT

Course Objectives:

The objective of this course is

1. Recognize the basic knowledge of History and Evolution of Quality Control and Management.
2. Illustrate the philosophy and core values of Quality Management (QM).
3. Develop the concepts and statistical methods employed for assurance of quality in products, processes and systems in an industrial environment.
4. Determine the effect of Process Capability Analysis and Introduction of Sampling Plans.
5. Apply and analyze the Concept of Reliability and Taguchi Philosophy for Quality

Course Outcomes:

On successful completion of this course, students will be able:

1. Develop conceptual understanding of Quality, Quality cost and value
2. Analyze and develop control charts for Statistical Quality Control.
3. To apply the knowledge of quality control and its tools for process capability.
4. Analyze and develop sampling plans for acceptance sampling.
5. Identify the concept of TQM and philosophy of quality leaders.
6. Identify failure pattern of product, Reliability and Maintenance.
7. Evaluate Reliability and MTTF and Examine Taguchi Philosophy for Quality improvement.

COURSE CONTENTS

Module 1

Introduction: Quality Control: Definitions, Place of quality control in industries, Quality control organization. Difference between inspection and quality control. Economics of Quality systems. Quality Assurance and its manual.

Module-2

Statistical Process Control: Sample size and frequency of sampling and control, Design and application of control charts for variable and attribute (X, R, C np, p, u chart). Process capability studies.

Module 3

Acceptance Sampling: AQL, LQL, Producer's Risk, Consumer's Risk, and Performance Measures of Sampling Plans: OC curve and ASN curve Single sampling plans. Double sampling and sequential sampling plans. Rectifying inspection for lots. Sampling plans for continuous production. Selection of sampling plans for different situations. Economics of acceptance sampling.

Module 4

Total Quality Management: Evolution of total quality management. Historical perspective. Elements



With effect from Academic Year 2021-22

of TQM: elimination of waste and problem exposure. Total quality control systems. Demings wheel, Deming 14 points-pros and cons in industrial engineering context, Philip Crosby philosophy, Juran Philosophy, Ishikawa Diagram. Quality function development, Quality circles & ISO 9000. Application of TQM to service type organizations. Various Quality Awards

Module 5

Reliability: Distributions encountered in controlling Reliability mean time to failure, Exponential failure density, MTTF, Weibull, Failure density, Measurement and Tests, Maintenance and Reliability, Robust Design and Taguchi Method Taguchi Philosophy for Quality Improvement, Quality Loss Function, Signal-to-Noise Ratio.

Text Books & References:

1. Grant E.L. and Leave Worth, Statistical Quality Control, TMH. 1996.
2. Amitava Mitra, Fundamentals of Quality Control and Improvement, Wiley, 2016.
3. Kapur K.C. and Lamberson, Reliability in Engg. Design Wiley Eastern.
4. Juran and Godfrey, Quality Handbook, TMH. 1998
5. Jain K.C. and Chitale A.K., Quality Assurance and Total Quality Management, Khanna Publisher, India, 2003.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Elective – V	3	0	0	40	60	100	3
IPPBTP4	4. Mechanics of Composite Material							
IPPBTP5	5. Smart Materials and Applications							
IPPBTP6	6. Mechatronics in Manufacturing Systems							

IPPBTP4 MECHANICS OF COMPOSITE MATERIAL

Course Objectives:

The objective of this course is

1. Understand the fundamental properties of composite materials;
2. Apply the fundamental principles mechanics of composite materials;
3. Apply modern analytical techniques to mechanical systems with composite materials;
4. Apply computational techniques to mechanical systems with composite materials;
5. Understand the manufacturing processes and cost analysis in composite materials;
6. Demonstrate effective communication and teamwork skills through technical presentations and reports in term projects.

Course Outcomes:

On successful completion of this course, students will be able

1. Determine composite mechanical properties from constituent fiber and matrix material properties including longitudinal and lateral moduli, Poisson's ratio, and shear modulus.
2. Determine the generalized stiffness and compliance matrix relating in-plane stresses to strains for a composite layer assuming plane stiffness.



With effect from Academic Year 2021-22

3. Apply classical laminated plate theory to determine extensional, coupling, and bending stiffnesses of a composite laminate. Also be able to perform this calculation using MATLAB for a composite laminate with many layers.
4. Fabricate composite laminates and built-up composite structures such as I-beams, box beams, or model-scale aircraft wings using a composite manufacturing procedure.

COURSE CONTENTS

Module 1

Introduction:-Definitionofcomposites;classificationofcomposites;Fibersandmatrix materialsandtheirproperties;generalizedHook'slaw-orthotropic,transversely isotropic and isotropic materials; constitutive equations under plane stress condition for orthotropicmaterials,restrictionsonelasticconstantsoforthotropicmaterials.

Module 2

MacromechanicsofLamina:-Stress-strainrelationsforalaminaofarbitraryorientation, invariantpropertiesofanOrthotropiclamina,strengthofanOrthotropiclamina,experimental determination of strength and stiffness, Biaxial strength theories of an Orthotropic lamina: maximum stress theory, maximum strain theory, Tsai-Hill theory, Tsai-Wu Tensor theory.

Module 3

MicromechanicsofLamina:-Mechanicsofmaterialsapproachtostiffness(determination of E_1, E_2, U_{12} & G_{12});mechanicsofmaterialsapproachtostrength;tensileandcompressive strengthinfiberdirections,elasticityapproachtostiffness,someresultsofexactsolution.

Module 4

MicromechanicsofLaminate:-Classicalaminationtheories(CLT)-laminatestress, laminate stiffness- A-B-D matrix and their implication, symmetric and non-symmetric laminatesinterlaminatestress,limitationsofclassicalaminationtheory.

Module 5

Short Fiber Composites: -Theories of stress-transfer, average fiber stress, modulus prediction,strengthprediction,effectofmatrixductility,Ribbon-Reinforcedcomposites.

Text & Reference books:

1. "Modern Composite Materials" by L J Broutman and R M Krock,
2. "Composite Materials – Science and Engineering" by K K Chawla,
3. "Mechanisms and Mechanics of Composite Fracture" by R B Bhagat and S G Fishman,
4. "An Introduction To Composite Materials" by D Hull, "STRUCTURAL COMPOSITE MATERIALS" by F C Campbell,
5. "Composite Materials" by Berthelot, "Electrostatic Discharge Sensitivity of Composite Energetic Materials" by Michelle L Pantoya and Chelsea Weir

IPPBTP5 SMART MATERIALS AND APPLICATIONS



With effect from Academic Year 2021-22

Course Objectives

The objective of this course is

1. Describe different types of smart materials in terms of underlying mechanisms, advantages and disadvantages
2. Select the most appropriate smart material system for a design problem under specified design constraints
3. Possess a general picture of smart material systems and knowledge about current research areas and future trends.
4. Design of sensors and actuators using smart materials and learn about Energy harvesting using piezoelectric materials
5. Describe Magneto rheological fluid and its applications

Course Outcome

On completion of this course, the students will be able to

1. Design and construct simple functional structures using smart materials.
2. Describe and characterize mechanical behavior of smart materials.
3. Characterize interaction between smart materials and simple structures in actuation and sensing.
4. Describe and characterize novel functions of smart materials using structure-property relationships.
5. Present and demonstrate the functions of smart structures.

COURSE CONTENTS

Module 1

Definition of smart materials, what makes them smart, sensors, actuators and transducers; introduction to different types of smart material, Smart materials; history and industrial application

Module 2

Piezoelectric materials – Crystallography and crystal structure, mechanism of piezoelectricity, Common piezoelectric materials, Applications, Derivation of constitutive laws from energy principle and its application as actuator, sensor, and energy harvester.

Superelasticity, superelastic materials phase transformation

Module 3

Shape memory alloys – Martensitic transformations, shape memory effect and super-elasticity, Mechanical behaviour and shape memory characteristics of different shape memory alloy systems, Ti-Ni Phase diagrams

Module 4

Thermally and Magnetically activated Shape memory alloy: constitutive modelling using phenomenological and thermodynamic approaches, its applications as actuator, sensor, energy dissipater, and stent like biomedical items, Design and Application of Shape memory alloys.

Module 5

Magneto rheological fluid: constitutive behaviour and its applications as damper, Behaviour of Electro active polymer and its use as artificial muscles; Properties of Magnetostrictive materials and Optical Fibre.

Text & Reference Books:

1. Mel M. Schwartz, Smart Materials, CRC Press, 2009.
2. Donald J. Leo, Engineering analysis of smart material systems, John Wiley & Sons, 2007.



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3. Jiashi Yang, Analysis of piezoelectric devices, World Scientific, 2006.
4. Ralph C. Smith, Smart material systems: model development, siam, 2005.
5. Vijay K. Varadan, Smart material systems and MEMS: design and development methodologies, John Wiley & Sons, 2006.
6. Seung- Bok Choi & Young-Min Han, Piezoelectric actuators: control applications of smart materials, CRC Press - 2010.
7. Antonio Arnau, Piezoelectric transducers and applications, Springer, 2004.

IPPBTP6 MECHATRONICS IN MANUFACTURING SYSTEMS

Course Objectives:

The Objective of this course is

1. Understand characteristics and the components of mechatronics systems
2. Discuss recent trends in Mechatronics
3. Describe active & Passive electrical circuits
4. Describe the techniques are of used to design a mechatronics process.
5. Suggest possible design solutions

Course Outcomes:

On completion of this course, the students will be able to

1. Identification of key elements of mechatronics system and its representation in terms of block diagram
2. Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O
3. Interfacing of Sensors, Actuators using appropriate DAQ micro-controller
4. Time and Frequency domain analysis of system model (for control application)
5. PID control implementation on real time systems
6. Development of PLC ladder programming and implementation of real life system.

COURSE CONTENTS

Module 1

Introduction to Mechatronics, Need of Mechatronics in measurement systems, Control systems, Traditional design.

Module 2

Feedback devices, Introduction of sensors and transducers, Performance terminology, Displacement, Position and proximity, Velocity and motion, Fluid pressure, Temperature sensors - Light sensors, Selection of sensors, Signal processing, Servo systems.

Module 3

Role of microprocessors in Mechatronics, Introduction of microprocessors and microcontrollers, Pin configuration, Instruction set, Programming of microprocessors using 8085 instructions, Interfacing



With effect from Academic Year 2021-22

input and output devices, Interfacing D/A converters and A/D converters, Applications - Temperature control, Stepper motor control, Traffic light controller.

Module 4

Programmable logic controllers(plc), Introduction, Basic structure, Input/output processing, Programming, Mnemonics timers, Internal relays and counters, Data handling, Analog input/output, Selection of PLC.

Module 5

Design and Mechatronics, Designing, Possible design solutions, Case studies of Mechatronics systems.

Text & Reference Books:

1. Histan Michael B. and Alciatore David G., "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 1999.
2. Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ, "Mechatronics ", Chapman and Hall, 1993.
3. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications" Wiley Eastern, 1998.
4. Lawrence J.Kamm, "Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics", Prentice-Hall, 2000.
5. Ghosh P.K. and Sridhar, P.R., "Introduction to Microprocessors for Engineers and Scientists, (0000 to 8085)", Second Edition, Prentice Hall, 2004.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Open Elective	3	0	0	40	60	100	3
MSPBTO1	9. Business Analytics							
IPPBTO2	10. Industrial Safety							
IPPBTO3	11. Operations Research							
CEPBTO4	12. Cost Management of Engineering Projects							
MEPBTO5	13. Composite Materials							
CHPBTO6	14. Waste to Energy							
ECPBTO7	15. IoT							
MCPBTO8	16. MOOCs							

MSPBTO1 BUSINESS ANALYTICS

Course Objectives:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.



With effect from Academic Year 2021-22

6. Manage business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes:

On completion of this course, the students will be able to

1. Knowledge of data analytics.
2. Think critically in making decisions based on data and deep analytics.
3. Use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Translate data into clear, actionable insights

COURSE CONTENTS

Module 1

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

Module 2

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Module 3

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Module 4

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Module 5

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Module 6

Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Reference:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G.



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Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

IPPBTO2 INDUSTRIAL SAFETY

Module1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Module 2

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Module 3

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Module 4

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module 5

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

IPPBTO3 OPERATIONS RESEARCH

Course Outcomes:

At the end of the course, the student should be able to

1. Apply the dynamic programming to solve problems of discrete and continuous variables.
2. Apply the concept of non-linear programming
3. Carry out sensitivity analysis
4. Model the real world problem and simulate it.



With effect from Academic Year 2021-22

COURSE CONTENTS

Module 1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Module 2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Module 3

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Module 4

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Module 5

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

CEPBTO4 COST MANAGEMENT OF ENGINEERING PROJECTS

Course Outcomes:

At the end of the course, students will be able to

1. Discuss the cost concepts in the cost management process.
2. Able to handle the projects by the application of project cost control methods.
3. Determine all types of costing and carryout the analysis of pricings for profitability.
4. Application of PERT/CPM for cost management.

COURSE CONTENTS

Module 1

Introduction and Overview of the Strategic Cost Management Process

Module 2

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Module 3

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance.

Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Module 4

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing



With effect from Academic Year 2021-22

and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control;

Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Module 5

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MEPBTO5 COMPOSITE MATERIALS

Course outcomes

At the end of the course, students will be able to

1. Explain and also implement the composite materials for the required performance based on the characteristics.
2. Adopt the composite materials as reinforcements.
3. Implement the methods of manufacturing of metal matrix composites
4. Adopt the methods of manufacturing of polymer matrix composites
5. Evaluate the strength of laminates.

COURSE CONTENTS

Module 1

INTRODUCTION: Definition – Classification and characteristics of Composite materials.

Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

Module 2

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

Module 3

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique,

Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix

Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

Module 4

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

Module 5



With effect from Academic Year 2021-22

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first ply failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

CHBTO6 WASTE TO ENERGY

Course outcomes

1. At the end of the course, students will be able to
2. Classify the waste for fuel and identify the devices for conversion of waste to energy.
3. Implement the Biomass Pyrolysis.
4. Evaluate the methods of Biomass Gasification and implement their applications.
5. To design, construct and operation the Biomass Combustion devices.
6. Classify biomass; apply the bio energy systems design and construction.

Module 1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Module 2

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Module 3

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Module 4

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Module 5

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production – Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. Wereko-Brobby and E. B. Hagan, John Wiley & Sons, 1996.



With effect from Academic Year 2021-22

ECPBTO7 INTERNET OF THINGS (IoT)

Course outcomes

1. At the end of the course, students will be able to
2. Understand the concepts of Internet of Things.
3. Analyze basic protocols in wireless sensor network.
4. Design IoT applications in different domain and be able to analyze their performance
5. Elaborate the need for Data Analytics and Security in IoT.
6. Understand the concepts of Internet of Things.

COURSE CONTENTS

Module 1

Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, sub netting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer. Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardware, Examples of IoT infrastructure.

Module 2

Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

Module 3

MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP, XMPP and gateway protocols, IoT Communication Pattern, IoT Protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE, SIG, NFC, LORA, Lifi, Widi).

Module 4

An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security, Common Challenges in IOT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

Module 5

IoT Physical Devices and Endpoints: Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, and reading input from pins.

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs WebServer: Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API.

IoT application and its Variants: Case studies: IoT for smart cities, smart grid, health care, agriculture, smart meters. M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0, IoT standards.

References:



With effect from Academic Year 2021-22

- “Internet of Things - A Hands-on Approach”, ArshdeepBahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547
- “Internet of Things”, Srinivasa K G, CENGAGE Learning India, 2017.
- ” IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
- “Getting Started with Raspberry Pi”, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
- “From Machine to Machine to Internet of Things”, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, Elsevier Publications, 2014.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Audit Course/Value Added Course	3	0	0	40	60	100	3
ELPBTX1	English for Research Paper Writing							
PEPBTX2	Stress Management by Yoga							
CEPBTX3	Disaster Management							
LAPBTX4	Constitution of India							

ELPBTX1 ENGLISH FOR RESEARCH PAPER WRITING

Course outcomes:

At the end of the course, students will be able to

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

COURSE CONTENTS

Module 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Module 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Module 3

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Module 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Module 5

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.



With effect from Academic Year 2021-22

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books).
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

PEPBTX2STRESS MANAGEMENT BY YOGA

Course Outcomes

At the end of the course, students will be able to

1. To achieve overall health of body and mind
2. To overcome stress
3. Develop healthy mind in a healthy body thus improving social health also
4. Improve efficiency

Module 1

Definitions of Eight parts of yog. (Ashtanga)

Module 2

Yam and Niyam.

Do's and Don't's in life.

- i) Ahinsa, satya, astheya, bramhacharya and aparigraha
- ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Module 3

Asan and Pranayam

- i) Various yog poses and their benefits for mind & body
- ii)Regularization of breathing techniques and its effects-Types of pranayam

Suggested reading

1. 'Yogic Asanas for Group Training-Part-I' :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

CEPBTX3 DISASTER MANAGEMENT

Course Outcomes:

At the end of the course, students will be able to

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.



With effect from Academic Year 2021-22

COURSE CONTENTS

Module 1

Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard and Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Module 2

Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Module 3

Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Module 4

Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

Module 5

Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Module 6

Disaster Mitigation Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.), "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

LAPBTX4 CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes



With effect from Academic Year 2021-22

At the end of the course, students will be able to

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

COURSE CONTENTS

- History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working).
- Philosophy of the Indian Constitution: Preamble, Salient Features
- Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.
- Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, appointment and Transfer of Judges, Qualifications, Powers and Functions.
- Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy .
- Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

- The Constitution of India, 1950 (Bare Act), Government Publication.
- Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
- M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBPT1	Mini Project	3	0	0	40	60	100	3



With effect from Academic Year 2021-22

IPPBPT1 MINI PROJECT

Course Objectives:

The Objective of this course is

1. To develop design skills according to a Conceive-Design-ImplementOperate (CDIO) compliant methodology.
2. To implement engineering skill and knowledge to complete the identified project work while encouraging creativity and innovation.
3. To develop spirit of team work, communication skills through group-based activity and foster self- directing learning and critical evaluation.

Course Outcomes:

On completion of this course, the students will be able to

1. Identify a problem based on the need analysis of community /industry/ research.
2. Create a flowchart of methodology for solving the identified problem
3. Demonstrate team work with work division, team meetings and communications among team members.
4. Write technical report for the project work and present the same through power point presentations or posters

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBLT1	Robotics lab	3	0	0	40	60	100	3

IPPBLT1 ROBOTICS LAB

Course Objectives:

The Objective of this course is

1. Learn about force and torque sensing
2. Learn about application of robot
3. Apply the basic engineering
4. The drive systems used in Industrial applications
5. Simulation Software for Industrial Robots

Course Outcome:

On completion of this course, the students will be able to

At the end of this course, students will demonstrate the ability to

1. Develop Ladder diagrams for PLC Programming
2. Work with simple Automation Systems using PLC
3. Analyze Forward and Inverse Kinematics for Basic Robots
4. Programming and Analysis of Industrial Robots using Software
5. Visualize the configurations of various types of robots.



With effect from Academic Year 2021-22

6. Describe the components of robots like arms, linkages, drive systems and end effectors.

List of Experiments:

- (1) Assignment on introduction to robot configuration
- (2) Demonstration of robot with 2 dof, 3 dof, 4 dof etc.
- (3) Two assignments on programming the robot for applications
- (4) Two assignments on programming the robot for applications
- (5) Two programming exercises for robots
- (6) Two case studies of applications in industry
- (7) Exercise on robotic simulation software